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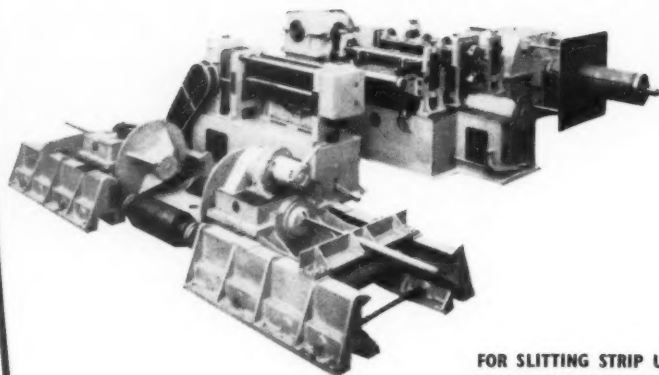
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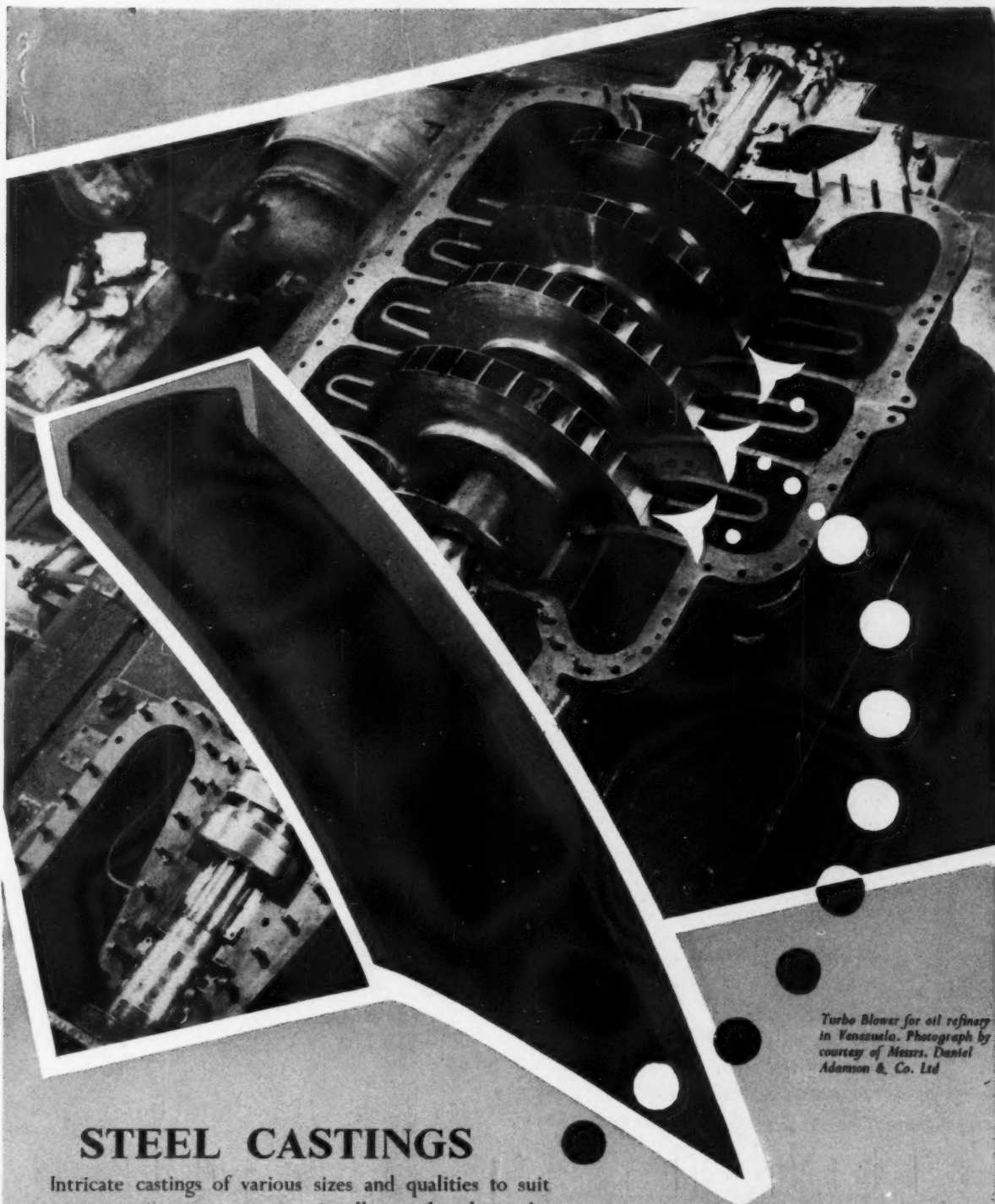
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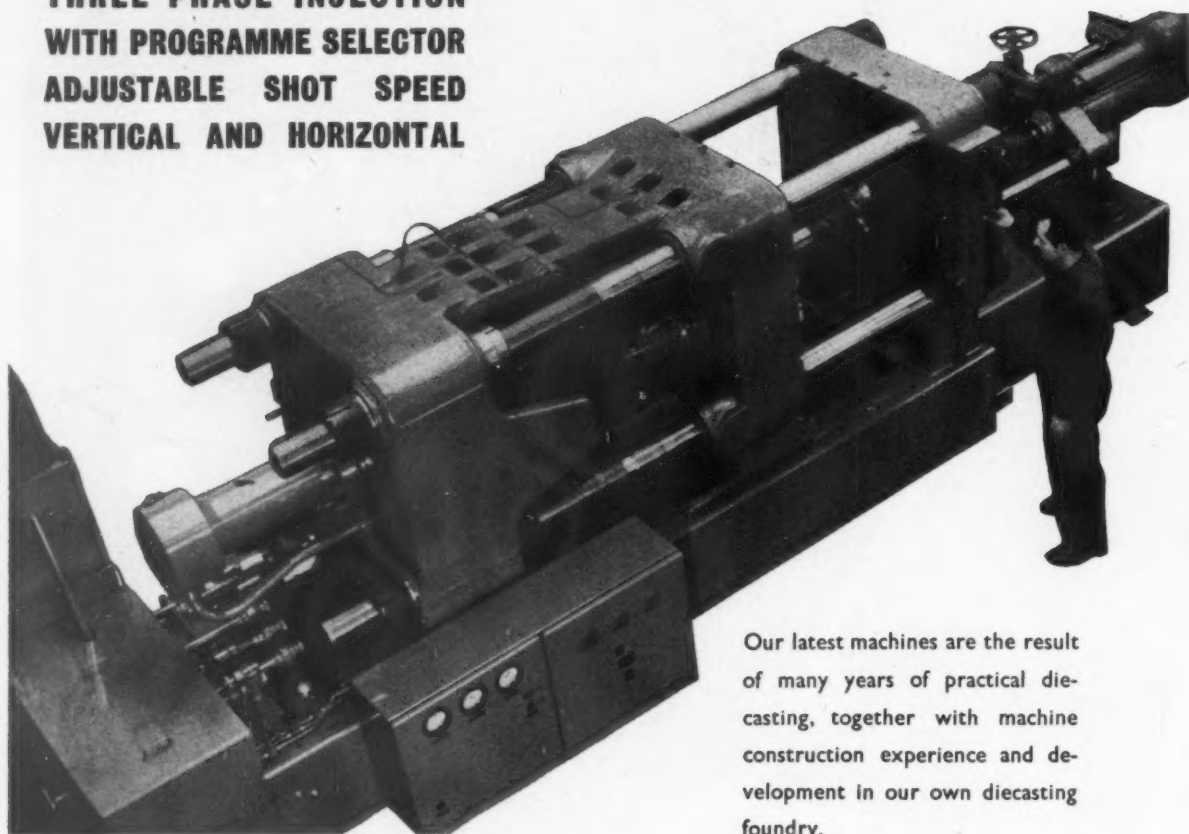
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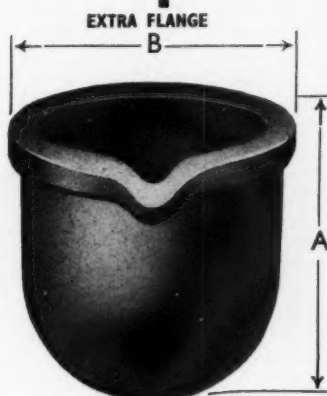
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14 1/2	375	18 1/2	463	9 1/2	235	63	35.2	150
15 1/2	402	20 1/2	527	10	254	82	46.7	200
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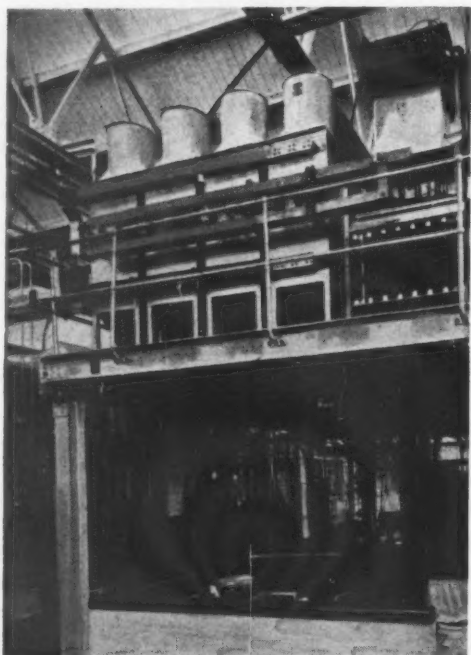
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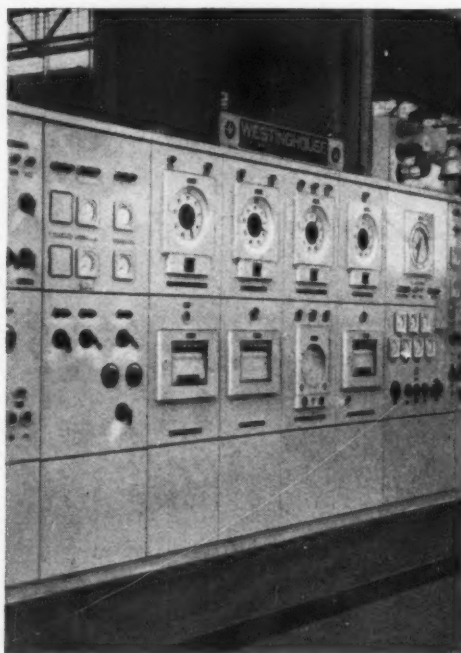


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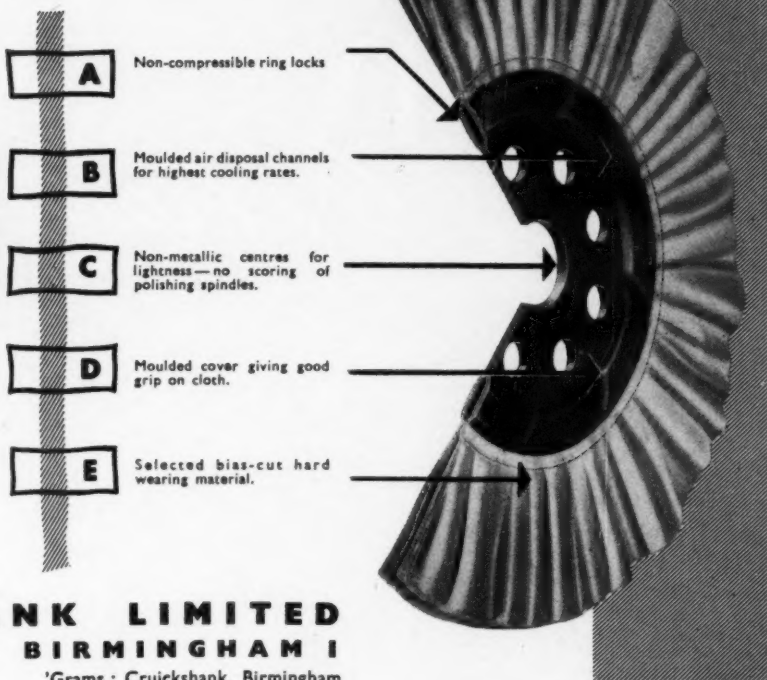
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# METAL INDUSTRY

FOUNDED 1909

EDITOR: L. G. BERESFORD, B.Sc., F.I.M.

27 FEBRUARY 1959      VOLUME 94      NUMBER 9

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# METAL INDUSTRY

VOLUME 94

NUMBER 9

27 FEBRUARY 1959

## Tin Quotas

**P**RODUCING members of the International Tin Agreement are to be allowed to increase their exports by a total of 3,000 tons during the three-month control period beginning April 1 this year. This announcement was made by the International Tin Council at its meeting in London on Friday last. The export limit for the second quarter will, therefore, be 23,000 tons. This announcement came as a surprise to most dealers. In anticipation of no change, the London tin market had been mounting steadily to reach a price of £777 per ton for three months metal. What the ultimate effect of the I.T.C. decision will be remains to be seen, but it is generally expected that prices will fall, with the extent of the fall being conditioned by the size of the bull account which has been built up. Already the setback in Kerb dealings has sent prices down to about the £773 mark, and the decrease in the outback raises the question of how long the Tin Council will now have to wait before it can start liquidating some of its buffer stock of 23,305 tons at a price just over £780. On an annual reckoning, the increase in exports will total 12,000 tons, but there will still be a deficit in world production relative to consumption of fully 18,000 tons. Much depends on the future rate of demand, especially from the U.S.A.

The reason for the export relaxation would appear to be two-fold. First, there was probably considerable pressure from producers for some relief from the drastically curtailed production of the last six months, and secondly, because the pool had made substantial sales of special fund tin. The Council's announcement also included the statement that the authority previously granted to the Buffer Stock manager to operate within the middle price range in the agreement, namely, £780 to £830 per ton, was further extended to the end of the sixth control period.

At the close of the meeting, the Chairman of the Council told a Press conference that a very substantial part of the Special Fund tin had been sold, and that as soon as the holdings had been entirely liquidated he would make an official announcement. However, he indicated that the Special Fund would be maintained, at least for the time being. The fifteen per cent increase in the quota for this second quarter brings the figure back to the level ruling prior to October 1958. It represents a cut of 40 per cent from the basic tonnages instead of a 48 per cent reduction. On the possibility of the I.T.C. obtaining further new members, such as the United States, Western Germany or Japan, the chairman pointed out that the current agreement expired in June 1961, and that a conference would be called next year under United Nations auspices to draw up a new or modified agreement, and that membership would be open to all parties to U.N.O. Under these circumstances, it was unlikely that new members would join the present agreement, but contact was being maintained with the countries concerned.

It is not easy, in the present circumstances, to say what the market prospects are. The beginning of the new quota period in April will undoubtedly be a crucial time for the market, and it may be that many merchants will prefer to wait until then before committing themselves. Meanwhile, it looks as if the Buffer Stock manager will have to go into retirement for a while.

# Out of the MELTING POT

## Precipitated

IN these days of specialization, fewer and fewer chemists can have the opportunity of leaving their chosen field in order to enter that of metallurgy, as was done by quite a number of outstanding metallurgists of the past. The lack of such chemists-turned-metallurgists must be one of the reasons why precipitation in metallurgical circles has hitherto referred only to something that happened in solid solutions and which only in the later stages of the phenomenon bore some resemblance to what precipitation is used to denote in the chemical field. Another reason is, of course, the unfortunate mind-cramping effect, so far largely-neglected, resulting from the overworking of a restricted vocabulary. If, overcoming laziness or diffidence, an effort had been made to coin a brand new term to refer to precipitation in solid solutions, or, better still, several terms to describe the several stages of the process and the process as a whole, "precipitation" might have been left to retain its more usual chemical connotations. In the circumstances, it is not unlikely that one would not have had to wait quite so long for somebody to think about the possibilities of precipitation (*sic*) in the metallurgical field. Be this as it may, somebody has now given the matter some thought and has come up with a process of precipitation of ceramics in molten metals. In doing this, the term ceramics has, incidentally, been misused or overworked in much the same way as precipitation—but let that pass. The process consists in dissolving one constituent of the "ceramic" in one volume of molten metal and the other constituent of the "ceramic" in another volume of molten metal. The two volumes are then poured and mixed together, whereupon the two dissolved constituents react to form the "ceramic" which precipitates (*sic*) out, the molten metal being allowed to solidify before the precipitate (*sic*) can settle out. Examples include thorium and boron dissolved in copper and reacting to form thorium boride, and thorium and silicon dissolved in aluminium. The size of the particles of the "ceramic" formed in this way is controlled by controlling the rate of cooling of the mixed melt. The presence of these precipitated "ceramic" particles in the metal produces a large increase in the high-temperature strength. In conclusion, it may be worth mentioning that the term suggested for this new technique is "melt saturation." Oh, well. . .

## Meaningful?

A PERIODICAL publication giving abstracts, or, in some cases, only titles, of research reports emanating from the atomic energy field would appear to be an excellent means of keeping an eye on developments in that field. This is reasonably true so far as the abstracts are concerned. Even if the details in many cases are beyond one's immediate understanding, the general import can, nevertheless, be grasped and the occasional radical novelty can be spotted. This is no longer so when the section of the publication is reached where reports are listed by title only. With no abstract to provide a word of explanation, or in some cases to bring one back to earth, some of these titles tend to leave one with an impression of doubt, puzzlement, bewilderment, whimsey, amusement, or just uncertainty as to the possible incidence of misprints. The following selections from a month's collection of titles provide some excellent examples: Semipermanent freeze

flue tests for HRT-CP. Zircex fluoride volatility combination. Zircex uranium sublimate loss. Hazards associated with thorium metallurgy. The hazard of using Government issue cream for protection against flash burns. High resolution tube rack. Modification of a dampometer for use with a free-oscillation dynamic rig. The reaction of molten metal with water. Zirconium highlights. High-explosive argon flash light source. Free-free gamet factors. Confidence intervals for the standard deviation of a normal population. A test of the age theory. Bibliography and abstraction of deentrainment literature. Simulation of the OSORT buttermilk reactor, loss of fuel flow. Final report on the fabrication of fuel test rabbits of Phillips Petroleum Company.

## More Imagination

HAVING observed that science-fiction writers are not interested in applying their imagination to such a mundane subject as the casting of metals, we were recently moved to do so ourselves (this page, METAL INDUSTRY, 13 February 1959, p. 122). The course pursued led in the direction of a gradual abandonment of the solid three-dimensional casting mould as we know it. Along the way, we noticed the open-ended continuous casting mould, and the even less "substantial" virtual moulds formed by rapidly revolving mould elements, and, finally, we arrived at mouldless casting. Where do we go from there? More important still, who, apart from the producers of lead and other metal shot, wants to go that far? In case it should be due to lack of imagination, perhaps a few suggestions may not come amiss. What, in the first place, is there to start with? Quite a lot. There are, to begin with, the various new refractory materials, like silicon nitride-bonded silicon carbide, boron nitride, etc., that can handle molten metals with no ill effects. There are the equipment and experience required for the production and utilization of vacua on an industrial scale. There is the familiarity with regard to the manipulation of inert gas shields derived from the inert gas arc welding processes, not to mention the first approaches to inert gas-filled enclosures and workshops. There are the various methods of resistance, arc, and induction melting, and, more recently, of electron beam melting. Finally, there is the possibility of applying punched card, magnetic tape or computer control to permutations and combinations of the above. What, then, are the situations to which all these assets can be applied? In one basic situation, molten metal could be applied to a small starting core with a view to building up the required cast shape. Imagine molten metal fed at a controlled rate from a small nozzle spaced a small distance from the surface of the core and moving over it in a controlled manner, with the core also moving in a suitable controlled manner if necessary. In another basic situation, solid metal could be fed, perhaps continuously, to a melting and casting "station," the cast shape being also continuously removed from this station. Imagine a rod being fed into an enclosure in which a freely-floating molten zone is maintained and controlled in such a way that the metal leaving and solidifying on leaving the zone does so in some desired shape. And now that we have seen where we could go from there, who's coming?

*Skimmer*

## REASONS FOR ITS OCCURRENCE AND APPROPRIATE DEGASSING METHODS

# Gas Absorption in Aluminium Alloys

By Dr. H. KESSLER

*Dealing with the reasons for gas absorption and with the appropriate degassing methods for aluminium casting alloys this article has been translated from "Aluminium." The author, who is associated with Aluminiumwerke, Nürnberg, G.m.b.H., makes special reference to the use of porous refractory in portable equipment for the distribution of the gas in fine streams.*

ONE of the most difficult problems in casting aluminium and in the treatment of aluminium melts in general is degassing. It is not only from the atmosphere, but also from the waste gases of melting and holding furnaces (other than those electrically heated) that liquid aluminium readily absorbs hydrogen, which is formed by dissociation of hydrogen-containing compounds existing in the air above the melt, irrespective of their composition. In all cases, dissociation will set free hydrogen which is absorbed by the aluminium melt mainly in atomic, but also in molecular form. In the case of supersaturation, hydrogen will segregate at the surface of the melt, where, at the high temperatures concerned, it will burn to form water vapour, if oxygen is present in excess. This water vapour will again tend to dissociate to give atomic hydrogen, which will be absorbed by the melt if the surface is not protected.

Hydrogen is present not only in the waste gases of furnaces heated, for instance, by gas, oil, or coke, but also occurs in furnaces heated electrically; in this case it is derived from the moisture in the air. Close observation has shown that the hydrogen content of alloys is especially high on very humid days. The moisture content of the air largely depends on local conditions. Under marine conditions the humidity would be higher but, because of its constancy, would not be so noticeable in aluminium melts as compared with Continental climates, where moisture contents of between 25 per cent and 80 per cent are possible and where, in consequence, the relationship between the gas content of the melt and the degree of humidity can be observed with particular clarity. Special care must be taken in the degassing of melts when the moisture content of the air is very high—this can be read from a hygrometer.

These considerations have shown that it is of great importance for the atmosphere of an aluminium foundry to be as dry as possible in the neighbourhood of the melting and holding furnaces. It follows that sprinkling water on the floor of the foundry, which is done to give the foundrymen protection from the heat, is highly detrimental to the liquid metal. Though this measure gives some relief to the operators, it complicates con-

siderably the fabricating of aluminium from the metallurgical point of view.

As all observations have shown, hydrogen is the only gas which is detrimental to aluminium in causing porosity. Hydrogen, dissolved in appreciable quantities in the liquid metal, affects considerably the quality of the castings. During solidification and cooling, pores will form which are filled with the segregated gas. In contrast, it has been suggested in Germany that the quality of aluminium castings can be improved by a high degree of hydrogen enrichment, since by this method gates and risers, which are required for the flow of molten metal during cooling and shrinkage, may be reduced in size, or even abandoned altogether. However, thorough investigation of this hypothesis showed that the proposed method is very crude and unrealistic. It by no means improves the properties of the castings. Numerous and randomly-dispersed cavities diminish the solid cross-section of the casting, thus reducing the tensile strength and elongation, and also lowering the notched-bar impact strength, which is not very favourable in aluminium alloys, to an undesirable level. Contaminating materials, such as slag inclusions and oxide films, which are necessarily present in such castings, are dragged into the liquid metal from the surface of the melt and retained in the solidified metal. This contamination, and the reduction in the solid cross-section, considerably impair the thermal conductivity of the castings. Castings resistant to abnormally high mechanical and thermal fatigue stresses, such as are required by the engine building industry, cannot be produced by this method. In Germany, the method described has been recently discussed, and it was thought that reference to it here should not be omitted. However, it must not be overlooked in the following considerations that complete degassing of casting alloys has no favourable influence on general flow and shrinkage properties. Some hydrogen should always be allowed to remain in the liquid metal. It must be left to the experienced foundryman to decide what quantity of hydrogen may finally be retained, to produce sound castings. It must be emphasized that excessive degassing markedly favours the formation of hot cracks and shrinkage holes in the castings. The latter defect may

occur as large isolated pores, or in networks of fine pores weakening the structure.

## Determining Hydrogen Content

The method used for determining the hydrogen content of the metal melts differs among individual plants, a distinction being made between highly sensitive laboratory procedures and tests which may be usefully applied in practice. In the author's foundry, the "Straube-Pfeiffer" test has been introduced as a particularly favourable method. The procedure is as follows: a test crucible is filled with molten metal and introduced into a container, which is then hermetically sealed and slowly evacuated by pumping. It is important that the pumping is carried out slowly to allow a solidification skin to form on the surface of the molten metal, and thus to prevent a spasmodic escape of the gas bubbles. In the solidifying zone, the pumping causes the formation of gas bubbles of considerable size, which increase the volume of the zone, and this permits an immediate assessment of the gas content from the surface appearance of the solidifying metal sample. The actual gas content is, however, determined accurately only after the sample is removed from the container and divided. It has been suggested that the container should be evacuated spasmodically by means of a reservoir vessel. In the author's opinion, the determination of gas contents by this method is unsatisfactory, since spasmodic evacuation forces out the gas contained in the liquid metal, leaving no blowholes. The sudden creation of a vacuum in gas content tests may, therefore, give a result suggesting the wrong conclusion, namely that the sample metal is completely or nearly free of gas inclusions.

## Suitable Degassing Methods

One of the best-known and simplest of degassing methods consists of reducing the melt temperature to immediately above the solidification point, since aluminium at melting point dissolves relatively little hydrogen and, moreover, allows a large amount of gas to escape from the metal. When dissolved in the melt, the hydrogen is in atomic form; following supersaturation of the melt in cooling, it becomes molecular, and in this manner escapes. The time and effort needed to allow cooling and subsequent reheating are negligible in actual practice.

The question now arises of how to

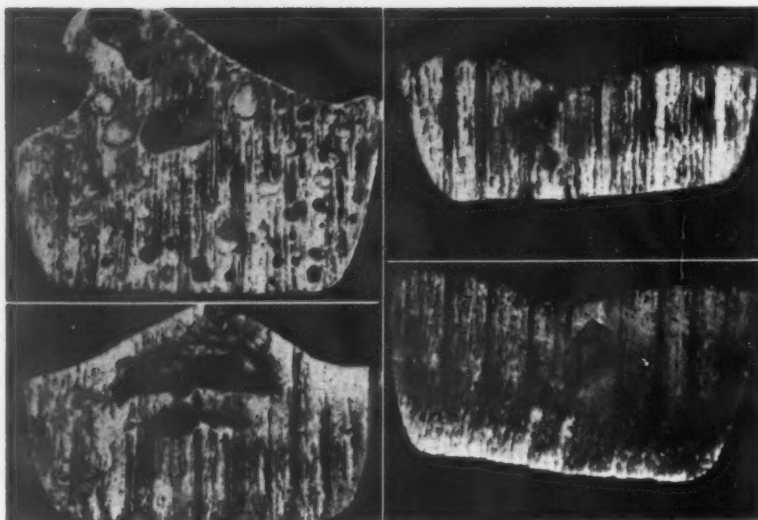


Fig. 1—Effect of time of degassing on the gas content of an aluminium melt using chlorine gas. The examples are from a heavily-gassed melt after chlorination periods of: 5 min. (top left); 10 min. (bottom left); 15 min. (top right); 20 min. (bottom right). Normal carbon tube approximately 31.5 in. (80 cm.) long. External diameter approximately 1 in. (25 mm.). Internal diameter approximately 0.4 in. (10 mm.). Metal melted in the gas furnace (graphite crucible)

degas aluminium melts most expeditiously on the foundry floor. The above-mentioned degassing method, using reduction in temperature, is not very suitable in practice, since useful effects are obtained only if the temperature is lowered close to the melting point and the melt is allowed to stand for long periods. The subsequent reheating required for casting the metal will destroy at least part of the degassing effect. From what has been stated earlier, it follows that degassing could also be achieved by the use of a vacuum. However, it was found that the technical installation required is far too complicated by comparison with other methods.

### Chlorination

The method which proved most useful consists in introducing chlorine gas into the melt. Great care must be taken to ensure that the chlorine is completely dry, and showing no trace of moisture, or degassing will be unsuccessful, or only partially successful, as a result of new dissociation. Moreover, it is important that the gas is introduced into the melt in the form of small bubbles. This has been achieved by passing it into the melt through carbon tubes for periods of 5 to 10 min., according to the hydrogen content of the alloy, the flow of gas being controlled at the rate of approximately 800 L./hr. (Fig. 1). It is essential to fit a flow meter to the individual equipment, since either an excessive or an inadequate flow would render the operation less effective; the effect is reduced even by excessive flow because the reactivity of large bubbles is small owing to their inadequate distribution in the melt.

Experience has proved that the intro-

duction of chlorine gas from cylinders is usually to be preferred to the release of chlorine from degassing tablets, as the flow of gas is more easily controlled. This method also has economic advantages, and avoids the risk of impurities being introduced in the melt, which may happen if tablets are used. Chlorination of the melt gives rise to a number of chemical reactions which, besides cleansing the melt, ensure that the absorption of fresh gas becomes more difficult, since chlorides formed from metals present in the aluminium alloy, such as magnesium chloride, precipitate as a sort of slag at the surface of the bath and, further, aluminium chloride vapour is present above this slag; this vapour holds back the hydrogen-containing constituents of the air or the waste gases, at least during the degassing operation. The

reactions occurring in the melt are difficult to assess, as the concentrations present in the reaction zone cannot easily be controlled. It is, however, certain that, by introducing the gas slowly and thus achieving a low rate of flow through the metal melt, not only is hydrogen removed, but the melt is also freed from non-metallic contamination, such as oxides, carbides, and nitrides. This cleansing may be regarded as a purely physical scavenging process. As is generally known, the chlorine gas is always introduced into the crucible from the bottom. By its steady upward movement in the melt, it exerts a scavenging effect comparable in some respects to filtration of the melt. If the chlorine were introduced too rapidly, the turbulent formation of aluminium chloride would cause extreme agitation in the bath, which might have just the opposite effect, due to the creation of vortices. Parts of the slag collecting on the surface could be dragged into the melt instead of being removed from it—as may be achieved by slow gasification. The chemical reactions of chlorine with hydrogen, on the one hand, and with other components of the alloy, on the other, prove that no other gas can have a similar cleansing effect. It must be mentioned that nitrogen has often been proposed for the cleansing of aluminium melts. The degassing and cleansing process is different for both gases, the efficiency being far lower for nitrogen than for chlorine. In treatment with chlorine gas, the rising aluminium chloride vapour picks up any oxide flakes, carbides, nitrides, and so on, and carries them to the top of the bath. Moreover, that part of the hydrogen which is in a molecular form is eliminated by a purely physical scavenging operation. A chemical reaction between aluminium chloride and molecular hydrogen is impossible for thermodynamic reasons, whereas such a reaction may occur with atomic hydrogen. It has been suggested more recently that the hydrogen chloride

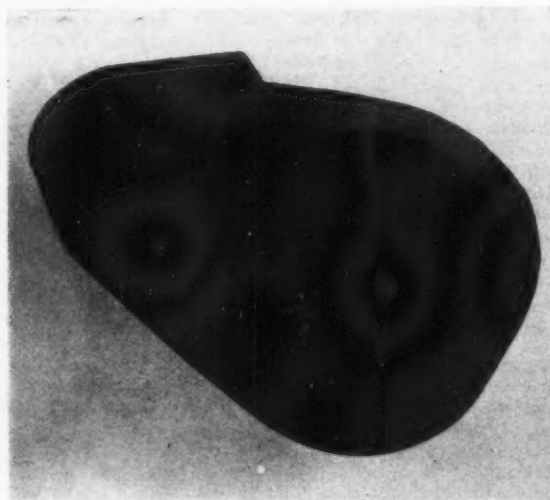
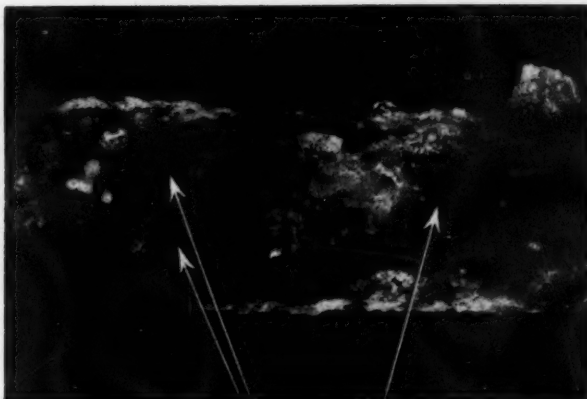
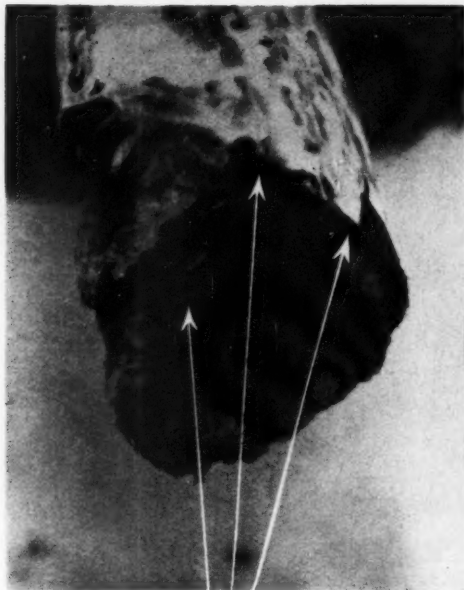


Fig. 2—Portable degassing equipment with porous refractory in a graphite block. The whole assembly is dipped into the melt by means of a carbon tube



Left : Fig. 3—Enamel-coated iron tube with a fault in the enamel coat at the mouth of the tube, and formation of iron chloride from the core material of the tube. Arrows indicate points at which the enamel coat remained partly intact

Above : Fig. 4—Enamel-coated iron tube with a fault in the enamel coat on the outer surface of the tube after removing the iron part of the tube. Arrows show the enamel coat below the chloride layer remaining partly intact

so formed will react with the aluminium, and the molecular hydrogen thus liberated, being attached to a rising stream of coated bubbles, will be drawn away in the physical scavenging operation. For nitrogen, a similar reaction with components of the melt is hardly possible; though it will likewise permit the physical scavenging which will filter molecular hydrogen out of the melt, as well as oxide films, carbides, and nitrides. The atomic hydrogen content cannot be removed, and may, indeed, even increase in the melt as a result of dissociation on the surface of the bath.

### Degassing Tests

The chlorination of aluminium melts may be carried out without difficulty by means of carbon tubes of appropriate sizes. The author uses tubes of about 80-100 cm. in length for small melting and holding furnaces. Their external diameter is approximately 25 mm., and their internal diameter roughly 8-10 mm. Difficulties naturally arise in portable equipment as soon as distribution of a particularly fine chlorine stream through narrow orifices or porous refractory is attempted. It may be pointed out that the aluminium chloride or magnesium chloride formed in the melt will naturally precipitate on the tubes. No trouble will be caused as long as the carbon tube is left in the melt; however, if the carbon tube is removed from the melt and, after cooling to room temperature, is in contact with the generally somewhat moist air, the chlorides, which are always hygroscopic, will readily absorb water vapour. In the case of insufficient preliminary heating and drying, these carbon tubes will, therefore, introduce moisture and slag-forming constituents to any new melt into which they are dipped while such

detrimental residues still adhere to them. However, the carbon tubes, with their smoothly polished surface, which is achieved by a pressing process, can be easily wiped clean with a suitable heat-resisting material. The case is different if the lower opening of the tubes is completely closed and replaced by fine holes at the sides of the tubes. These holes may lead to the destruction of the tube, for they present the risk of initiating the breaking up of the tubes owing to the hygroscopic substances embedded in them. This inconvenience is aggravated by the fact that the extent to which the holes are blocked up varies at the different levels of a tube.

Unfortunately, it was found that the upper holes, that is, those nearer to the melt surface, are alone responsible for the degassing of the upper part of the melt, whereas in the lower part the emergence of gas bubbles is almost completely prevented, as the holes are subjected to the hydrostatic pressure of the metal. These difficulties are increased when porous refractory nozzles are dipped into the melt (Fig. 2). Hygroscopic chlorides are likewise formed in the pores of the refractory nozzles and even after a single application of this fine-pore degassing equipment, reactions are observed which lead to the complete destruction of the refractory nozzle; for it is just not possible to remove the undesirable residue, that is, moisture-sensitive chlorides, from the finely porous system as easily as from a smooth tube wall. Preheating following the cooling of such porous material eliminates only some of these difficulties, since preheating tends to enlarge the fine fissures which are produced, particularly in portable degassing equipment. If traces of moisture are introduced into the melt, dissociation of the water vapour will

result, producing in turn, as previously described, enrichment of the melt with hydrogen; and, in the case of a larger volume of moisture, some of the melt will vaporize, or even be thrown out.

The difficulties mentioned were not observed in stationary equipment, i.e. chlorine converters. On the one hand, the temperature of the furnace equipment does not drop far enough to create the risk of absorption of moisture by hygroscopic salts. On the other hand, chlorination is often preceded, and followed, by sufficient nitrogen gassing to clean the pores at the bottom of the converter. With careful handling, good results were obtained by the remelt department of the author's company, using such gassing equipment provided with fine nozzles, particularly as the individual parts of the stationary equipment can easily be replaced.<sup>1</sup>

As with smaller furnaces, it is essential to distribute the chlorine stream as finely as possible in portable equipment. Various suggestions were made with the object of obtaining more favourable results, taking into consideration the fact that carbon tubes which withstood the test after immersion in the melt at the opening in the crucible base, when submitted to rough treatment in casting were greatly exposed to the risk of fracture. For this reason, tests were also carried out with other tube materials.

### Enamelled Tubes

For the solution of the problem, mention should be made of a suggestion which was pursued at great expense, though with very little success. Enamels resistant to high temperature and chlorine gas have recently been developed. They afford adequate protection to iron tubes against the attack

(Continued on page 169)

## I.M.F. Sheffield and North-East Branch Dinner and Dance

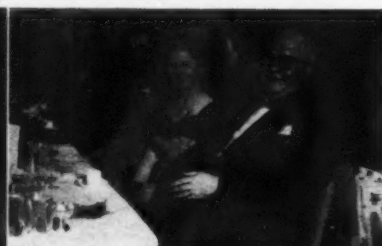


SHOWN in these pictures are some of the members and their guests who attended the Annual Dinner and Dance held by the Sheffield and North-East branch of the Institute of Metal Finishing at the Grand Hotel, Sheffield, on February 13.

Left: Mr. J. Pigott, Mrs. Pigott, Mrs. A. R. Knowlson, Dr. T. P. Hoar



Above left: Mr. D. Allen, Miss Hutchinson, Mr. and Mrs. A. E. Hutchinson, Mr. and Mrs. E. Perkins, Mr. A. Oldham. Above right: Mr. G. Billham and Party. Below left: Mr. J. Woods, Mrs. Pigott, Dr. T. P. Hoar, Mr. Pigott, Mr. and Mrs. F. Savage, Mr. and Mrs. W. Nowill, Mr. and Mrs. L. G. Beresford, Mr. J. Pigott, Jr., Mrs. Woods. Below right: Mr. and Mrs. R. Nicol, Mr. John Sprague and Miss E. Sprague



Above left: Mr. and Mrs. R. Cooper, Mr. and Mrs. R. A. Jackson, Mrs. C. J. Brown

Above right: Mr. E. Hague, Mrs. R. A. Nicol, Mr. and Mrs. L. Woods, Mr. S. Smith, Mr. and Mrs. G. Gillam, Mrs. Woods, Mr. R. A. Nicol, Mrs. Hague, Mr. A. Hague, Jr.

Right: Mr. G. L. Atkin, Mr. and Mrs. A. Knowlson, Mrs. F. Thompson, Mr. A. R. Knowlson

Below: Mrs. W. Marshall, Mr. A. Jessop, Mr. H. Hill, Mr. W. Marshall, Mrs. G. Bloomer, Mrs. A. Jessop, Mrs. Hill, Mr. G. Bloomer, Mrs. A. Marshall

Below right: Mr. Byrne and Party



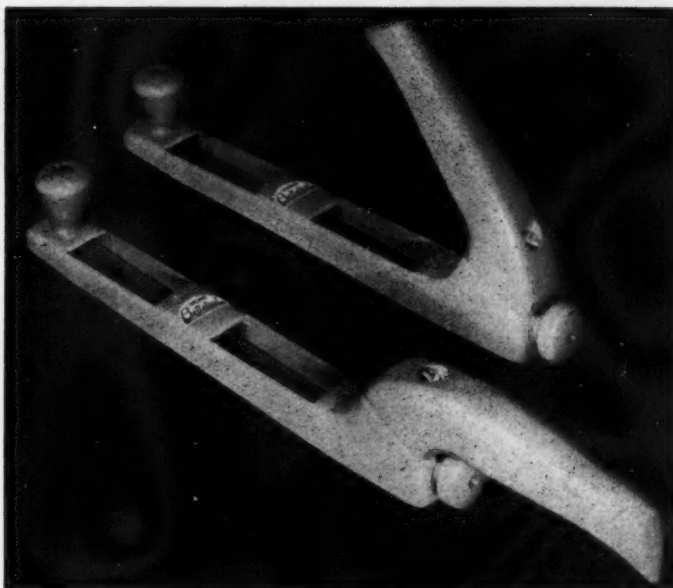
## Pressure Die-Casting Review

# Die-Cast Tool Frame

**I**NTEREST in the "do-it-yourself" market continues to grow, and the range of kits and tools now produced for the amateur craftsman is constantly widening. The demand for the popular range of tools has been large enough for a number of manufacturers to use the pressure die-casting process, with its advantages of high reproducibility, economy and fast production speeds, for bodies and frames of many tools, saw frames, drill bodies, planes, and so on. One of the recent entrants into this field is the "Bettatool," a twin-purpose plane or file, a product of Archibald Kenrick and Sons Limited, of West Bromwich.

This tool, shown in the illustration at the head of this page, has a detachable handle that can lie in two positions, one for planing and one for filing. One of its features—and one that distinguishes it from competitive products—is the reversible cutting blade; when one side is worn it can be turned over to present a new series of cutting teeth.

Fig. 1—Pressure die-cast frames and locking nuts in zinc alloy. These frames are shown in their relative positions as-cast on the runner and sprue system, the fourth has been trimmed



The "Bettatool"—a combination tool with interchangeable position for the handle

The castings for this tool are shown in Fig. 1. The body is cast from a four-impression die (Fig. 2), the arrangement of the castings on the sprue and runner system being indicated. Both the body and the blade locking nut (Fig. 1) are cast in zinc alloy. As cast, the body requires only one drilling and two tapping operations, apart from trimming. The recess in which the handle locates is

cast-in, a slot for the blade locking nut is included, and another for the blade retaining pin at the "heel." The channel section provides ample strength and rigidity, and the rectangular apertures in the top of the body help to control the distribution of the weight, and allow shavings to clear easily. Thus, the tool is well balanced, yet it has the firm solid "feel" which appeals to the craftsman.

The casting problems associated with the production of a long thin casting of this sort were considerable, and much thought had to be devoted to the positioning of sprue, runners, gates, and to the heat distribution in the die. The solution to some of these problems will be apparent from Fig. 2, and from a description of the die.

Made from chrome-vanadium steel, heat-treated to 320 Brinell prior to machining, the die was arranged to take four impressions of the "Bettatool" body, the female impressions being in the same half of the die as the sprue. It was necessary with such a long thin casting to dispose the impressions centrally in the die block, and the problem of feeding the extremities demanded special consideration. From the central sprue, the runner system was led to a gate adjacent to the heavy section of each casting. At the opposite end of each impression, an overflow well was provided, thus improving both feed and heat distribution in the die. A further well, linking the impressions as a tie-bar, assisted feeding and served to maintain the castings in their relative positions—a point of some importance since it was envisaged that the spray of castings would be clipped in multiple tools, and

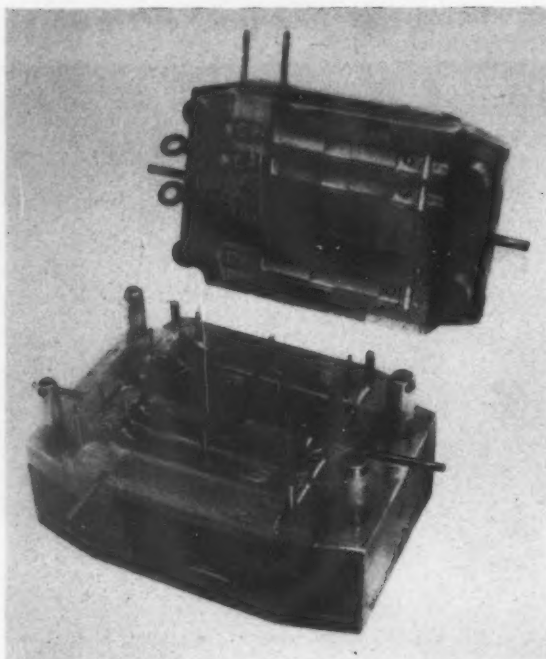


Fig. 2—The die set used for the production of the "Bettatool" frame

positive location as a complete spray was thus essential.

In early tests with the die it was

found that the outer castings had a better finish than the inner ones. These outer impressions were fed via

a runner with a slightly reduced section, and the results suggested that a reduction in runner section might improve the finish generally, a modification that was later carried out. The water-cooling system was also modified as the runner section was reduced.

The design of the spreader is such that a high proportion of the sprue is blanked off, the metal feeding down one side of the sprue only, a device that assists the cooling of the spreader and improves flow. Another feature of the die is that the water-cooling channels around the sprue area overlap those around the spreader.

One of the problems of die design is that of providing adequate support for the ejector plate. If support is spread by the use of four columns, contraction differences may cause jamming. For this reason, the die makers, Fox and Offord Limited, make a practice of central support for the ejector plate wherever possible. In this die, the ejector plate pin contacts the knock-out on the machine in a central position. The pin slides in an oil-less bush, and the ejector pins float in the ejector plate; thus, contractions in either die or ejector plate do not interfere with ejection.

Since the ejector plate is as large as the impression area, four support columns pass through the ejector plate to support the back of the die.

## POSITIONING CAVITIES FOR CASTINGS WITH THREE OR MORE ELEMENTS

# Design of Die-Castings

## X—Cams, Gears and Components of Mechanisms

By H. K. BARTON

(Concluded from METAL INDUSTRY, 20 February, 1959)

**R**EEL-LIKE configurations of one sort or another are met with in a variety of mechanisms, and most can be satisfactorily die-cast by one of the methods described. This is not invariably the case, however, and one class of assemblies can hardly ever be cast in a single unit. This consists of assemblies which have undercuts on the inward-facing surfaces; it is only when these are localized at the parting-plane (like the small bosses in Fig. 10) that the assembly can be die-cast in one piece. Should the inward-facing surfaces carry features such as, for example, crown gearing or a side-acting cam, it becomes necessary to cast the two flanges separately and to modify the design so that this may be done with greatest effectiveness.

Often the most effective way to do this is that of Fig. 11, where one flange and the hollow spacing pillar are cast as a unit. The end of the pillar is shouldered and splined, and the cored hole in the separate flange is made an interference fit. The two parts are assembled under a toggle-press, using

a flat-faced punch, heavily spring-loaded, to force the flange down the pillar on to the shoulders. At this point the punch-spring compresses, but the central guide pin, which is rigidly mounted, descends another  $\frac{1}{16}$  in. or so and stakes the thin rim into a countersink on the top face of the assembly, as seen in the enlarged detail at the right of Fig. 11.

In effect, this method gives the designer an extra dimension to work in, for instead of being able to utilize only the outer faces of spool-like assemblies, the method of Fig. 11 makes possible as much complexity on the two opposed inner faces as on the outer ones. The number of separate mechanical elements in the assembly may thus, if necessary, be increased. Instead of the integrally-cast spacing pillar of Fig. 11 (which is, of course, designed for free rotation upon a shaft) an assembly of the same sort may be formed by casting a steel insert into place within one flange, and assembling the other under a press in correct angular position.

The steel insert may itself include mechanical elements, as, for example, a worm drive, but care should be taken

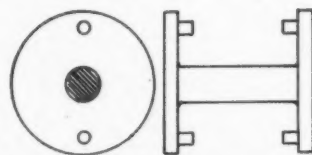
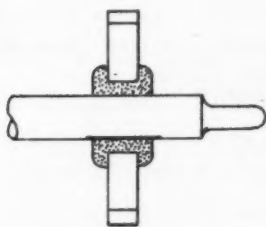


Fig. 10—A reel-like component which can be produced from a two part die only if all four pegs lie in the plane of the die-parting

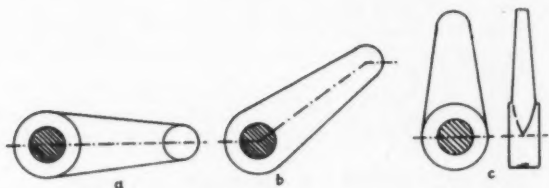
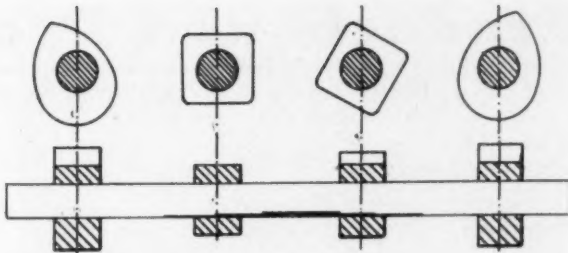
Fig. 11—A two-piece reel for assembly in a separate operation





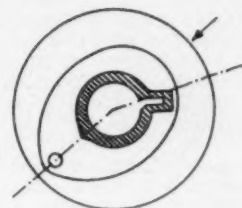
Left: Fig. 12—Assembly of gear and shaft by injection of a low-melting-point alloy

Right: Fig. 13—Several separate castings may be cast-in-place upon a single insert



Left: Fig. 14—By small modifications of form, levers and cams of almost any angular disposition may be produced from a two-part die. The chain-lines indicate the parting

Right: Fig. 15—An irregular parting can produce the cam and hollow shaft, but the circular head requires a separate slide



to see that these are shaped and located so as not to offer passages into which molten metal may be forced at injection. If a steel shaft carries much machining, it may well prove better to assemble both flanges under a press rather than use the shafts as inserts, for there is always a high mortality among cast-in inserts. This is especially so if it is not possible to run the die without inserts in, since then it is necessary to salvage inserts from sub-standard components.

In this connection one may mention a method of assembly that has been used very successfully on small mechanical parts, gears and shafts, cams, light-duty linkages, and so on. This entails the casting of the die-cast element—which may, of course, be composite—with a generous clearance where it is to be united with the shaft. After all necessary trimming has been carried out, the die-casting is placed in a second-operation die and the shaft placed in position. The die is then closed, leaving an annular or reel-shaped cavity at the transection of the two parts, and a low-melting-point alloy is injected into the space thus formed (Fig. 12). This rigidly unites the casting and shaft in correct position; as the second-operation die operates at a very low temperature, little dimensional variation takes place and extremely accurate assemblies—in respect of both concentricity and alignment—are achievable.

Up to the present, it must be stressed, only a few large users of small die-cast mechanisms have installed the special-purpose second-operation assembly machines needed for this method; so far as is known no contract die-casters have taken it up. It is, indeed, essentially a user's process; the risk of contaminating large quantities of high-purity die-casting alloys, by the accidental remelting of a few assembled components carrying lead-tin-antimony bosses, is too great to be acceptable to any responsible producer.

Reference was made above to the

casting of several isolated elements, simple or composite, upon a single steel shaft (Fig. 13) placed in the die as an insert. This is a simple and most economical way of producing ordered sequences of cam movements and intermittent gear displacements. The profiles possible upon the separate elements are not unduly restricted, but they must all have a common stripping direction and a common line of ejection, though these two axes need not necessarily be parallel.

Many mechanical elements allow considerable latitude of placement; levers of simple form, for example, can be stripped and ejected from any angular position (Fig. 14), though *a* and *c* are (in that order) preferable since they give a plane die-parting. An angular disposition, as at *b*, is, of course, adopted when an element of less adaptable form, as, for example, the cam of Fig. 15, with its rectangular dog, dictates a non-planar parting. Although the intermediate components cast in this way must be free from undercuts, and so cannot be recessed or lightened, the end faces of the two

outer elements can carry additional features or be hollowed out. If, therefore, there is any choice of position (and the linear sequence along the insert can usually be altered by changing the angular disposition of the elements), the thickest-sectioned castings should go to the ends. Whether, in fact, they are to be recessed out for lightness, which entails the use of laterally sliding blocks to house the ends of the insert, should be discussed with the die-caster.

The end positions may also be used for the location of geared elements—both face-gears and spur-gears—for these cannot be cast at intermediate positions. If a spur-gear is required it should preferably be shrouded, for its cavity will lie wholly within the sliding block, and a fairly heavy flash is likely at the junction of the slide and the main die members. This flash is best lathe-trimmed, centring by the insert. For similar ease of trimming, it may well prove most economical to cast even irregular end features with a circular shroud when they are formed by lateral blocks in this manner.

## Gas Absorption in Aluminium Alloys

—continued from page 165

of both liquid aluminium and its alloys, and also the chlorine gas. The tests made proved highly successful up to a certain point. However, in the end the success was greatly impaired by the human element. If the tubes were handled as carefully in the foundry as they are during tests in the laboratory, no difficulties would arise. It has, however, been found that it is not possible to ensure careful handling for any length of time, because the enamel coatings are extremely brittle and chip easily when set down carelessly, or accidentally knocked. If the protective enamel coating is removed from the iron tube even over a very small area, iron chloride, which sublimes at 319°C., will form immediately by

reaction between the iron of the tube and the chlorine gas flowing through it, at the temperatures (approximately 700°C.) which are usually present in aluminium melts. After repeated chlorination, the iron core of the tube is destroyed by sublimation, forming iron chloride, and only the enamel jacket remains (Figs. 3 and 4); the iron chloride reacts with the aluminium, resulting in an increase in the iron content of the melt. There is no need to emphasize that the empty enamel jacket does not resist any mechanical stresses, and that its fracture can only add to the contamination of the melt.

### Reference

<sup>1</sup> German Pat. DGM 1,726,983.

# Products and Processes

TRENDS IN THE DEVELOPMENT, APPLICATION, PROCESSING, DESIGN  
AND WORKING OF NON-FERROUS METALS AND THEIR PRODUCTS

## Spray Brazing

MANY fabrications where welding has been impracticable hitherto, as in the case of the compact light heat exchangers now being widely produced, are being successfully joined by a technique described recently in *Iron Age*. The method uses an ordinary oxy-acetylene torch, and an overhead hopper containing, in powder form, a nickel-silicon-boron brazing alloy. The brazing alloy contains 93-25 per cent nickel, 3-5 per cent silicon, and 1-9 per cent boron, and has a melting point of 1,055°C. The powder particles have a spherical form that ensures good flow characteristics, and a minimum surface area that reduces oxidation. The dust content of the powder is low.

In practice, controlled amounts of gases and powder are passed through a single-size one-piece tip and blowpipe. The flow of gas to the tip sucks the powder into the flame, where it melts and provides an easily-guided spray. The powder flows from an overhead 10 lb. hopper, down through a rubber tube, to a simple, thumb-operated on-off valve on the torch, by which the powder feed is controlled.

Tests have shown that joints in heat exchanger tubes and headers made with this equipment are leakproof, strong, and do not exhibit grain growth or other abnormality. Slight porosity observable in microscopic examination is discontinuous. Other applications have included sprayed-on corrosion-resistant coatings, the seatings for high pressure steam valves, attaching clips, bolts, etc., to prefabricated structures, and tangential joins in the thrust chamber of a rocket.

## Handling Coils in Confined Spaces

FOR handling press tools, or coils of strip metal up to 5 ft. in diameter and 20 in. wide, a new "Worksaver" electric truck has been introduced by The Yale and Towne Manufacturing Company.

A variety of specially designed attachments can be supplied for the truck. For coil handling, a ram or a pair of forks, shaped to minimize damage to coils, may be used. A semi-circular ram would be fitted to permit coils to be directly removed from coil-winding machines.

A solid platform or a pair of forks may be used to handle

press tools in circumstances where the use of a die-handling truck or large fork truck would not be practicable because of space limitations or cost.

Pedestrian-controlled and fitted with heavy-duty straddle legs, the "Worksaver" can operate in spaces too restricted to allow manoeuvring of counterweighted trucks.

Equipped with fixed, upright mast channels of similar design to those used in Yale Series 51 fork trucks, coils can be lifted to a height of 64 in. by a truck having an overall height of 90 in.

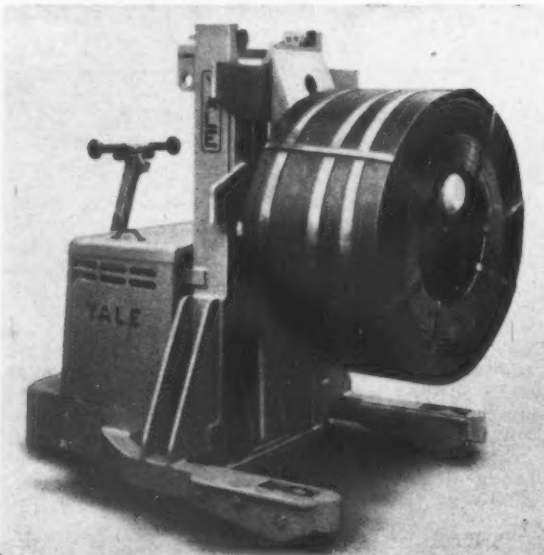
Like all "Worksaver" trucks, travel and lifting controls are conveniently placed on the steering handle. Operation is simple, and special truck operators are not required.

## Sequence Control for Industrial Processes

APPLICATIONS of sequence timers are so widespread it is difficult to pinpoint any industry that will give an adequate picture of their wide usage. The intermittent, albeit regular, application of abrasive or polish in automatic polishing operations, control of drying or curing times where heat intensity may require to be stepped up or varied in a preset sequence, laboratory process control where a single instrument may be required to be adaptable to many operational sequences according to the demands of the investigation on hand, reverse current chrome plating, automatic plating sequences—all these are potential applications of the sequence timer. To meet the demands of industry, Electrical Remote Control Co. Ltd. manufacture a range of compact and versatile instruments, the latest addition to which is a heavy-duty motor-driven multi-circuit mercury tube timer, type SAT, capable of continuously repeating a predetermined sequence of operations. Alternatively, it can stop after a single complete timing cycle if one of the mercury switches is wired in series with the motor of the timer. This instrument is most suitable for direct switching of highly inductive loads, with the contact arcing occurring inside sealed mercury tubes only.

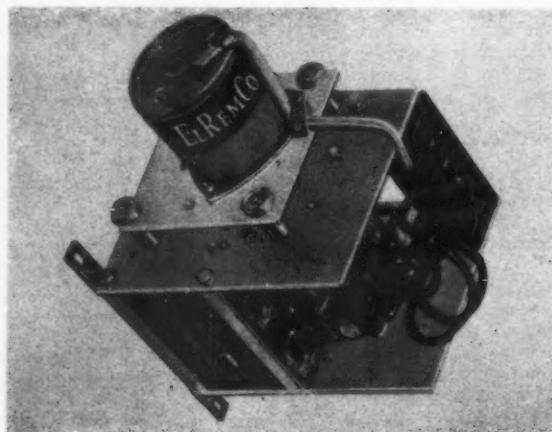
These timers are available with practically any shaft speed between one revolution in 1 sec. and one revolution in 28 days.

Single pole or changeover tilting mercury tubes with switching capacity of 5 amp., 10 amp., 15 amp., 20 amp., or



Left : The Yale "Worksaver" fork lift truck with attachment for coil handling

Below : One of the Elremco type SAT multi-circuit mercury tube timers



30 amp., are fitted as standard. The timer can have any number of cams and mercury tubes, but if units with more than 24 cams are required, the timers have two or more timing shafts driven from a common motor.

### Safe Containment of Radiographic Isotopes

A RANGE of isotope containers for gamma radiography that are "safe" at the surface has been developed to hold the activities commonly used in radiography.

The standard container, weighing about 30 lb., is for Iridium 192 or Caesium 137. It has been designed to give a maximum radiation level of 7.5 mr/h at surface, when loaded with  $2\frac{1}{2}$  curies of Iridium 192. Even when loaded with  $2\frac{1}{2}$  curies of Caesium 137, the radiation level would be 7.5 mr/h at only 10 in.

A smaller version, for Thulium 170, which will shortly be available in higher activities than before, is shown in the illustration below. This container weighs only 8½ lb. With care, it could be used by experienced operators for Iridium 192, since the radiation would not exceed 7.5 mr/h at one metre, when loaded with  $2\frac{1}{2}$  curies; the low weight would cause less fatigue; also, the container can be opened from a distance, by using the handling rod. A third model for Cobalt 60 will be available later. This will weigh about 70 lb., and is designed to give a radiation level of 7.5 mr/h at 1 m., when loaded with 2 curies.

The simple lightweight handling rod is suitable for all these containers; standard length is 3 ft., but it can be supplied in any length required. The manufacturers are the recently-formed organization R. F. Fraser-Smith.

### Hardness Tests on Large Workpieces

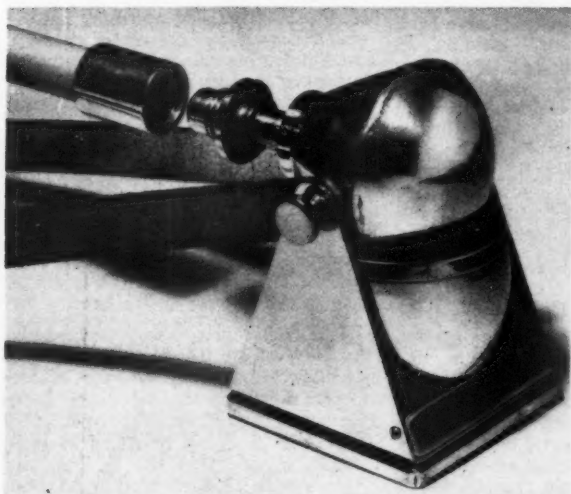
A BRINELL hardness testing machine, which has been specially designed for testing large components, has recently been completed by Edward G. Herbert Ltd., who build this equipment under licence from the Tinius Olsen Testing Machine Company. In this machine, the hand-operated type Brinell head, similar to those incorporated in the standard machines, has been fitted into a substantial crosshead. The Brinell head consists of an 8 in. diameter 0-3,000 kg. pressure gauge, checkweights, hand-operated pump, and 10 mm. diameter ball support assembly.

The crosshead is supported on two screws which are located in the heavy cast iron base, and is adjustable to any vertical position by a handwheel.

With a table 44 in. by 24 in., this particular machine has 30 in. clearance between the screws, and is adjustable up to

Right: Tinius Olsen hardness testing machine designed for use with large workpieces

Below: The isotope container produced by R. F. Fraser-Smith



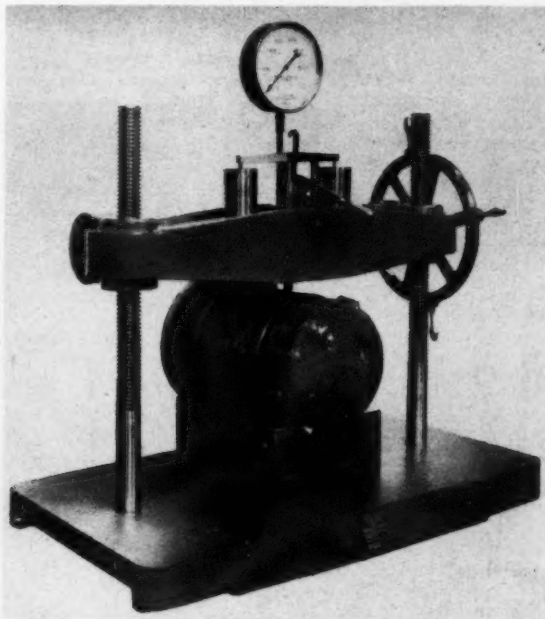
Part of the Metropolitan-Vickers Electrical Company's fettle shop, showing, in the left foreground, a wire hand brush fitted with a cowl. The flexible extraction tube is clearly indicated. Beyond, working on different castings, are three radial grinders fitted with Dustuctor extractor heads

a maximum height of 24 in. between the base and the 10 mm. diameter steel ball. These sizes can be varied to suit individual requirements.

### Dust Control in Foundry Work

AN efficient method of extracting at source harmful respirable dust, and removing it from the breathing area of the operator, has been developed by The Dustuctor Company Limited, a member of the Holman Group. The low volume, high velocity system is particularly important where high speed portable power tools, such as sanders, grinders and cutting-off wheels, which create large volumes of dust, are used in foundry fettle shops, engineering works, etc.

The Dustuctor system operates by attaching an extractor to the hand tool near the source of the dust, and a suction is created (a depression of 5 in. of mercury) which extracts approximately 35 to 40 ft<sup>3</sup>/min. of free air through the extractor head. A high speed turbo-exhauster creates the suction, and a ¾ in. diameter flexible hose is taken from the extractor head to the filter unit.



## REVIEW OF CONTRACTS AND ACTIVITIES UNDERTAKEN BY G.E.C. IN 1958

# Electrical Plant and Developments

**W**ITH the growth of the nuclear energy industry, new applications have arisen for non-ferrous metals, and consequent upon them, new types of electrical equipment have become necessary in the working of non-ferrous metals. Further, builders of electrical plant are entering new fields, as is shown by the following details of some of the activities of The General Electric Co. during 1958.

In the atomic energy field, the high-temperature gas-cooled zero-energy reactor known as "Zenith" is being built for the United Kingdom Atomic Energy Authority at Winfrith Heath, in Dorset.

The reactor core is roughly circular in plan, and is made up from 235 fuel elements. Each element consists of a large number of enriched-uranium and thorium ceramic discs, with graphite spacer discs, enclosed in a graphite tube. The core is entirely composed of these elements, no additional moderator being used. Surrounding this core is a reflector which is built from about 26 tons of graphite blocks and is provided with a number of holes, mainly at its inner edge, for control rods, depletion rods, and thimbles for flux, temperature, and other measurements.

The construction of "Zenith" is now well advanced, and the reactor is expected to go critical during the summer of 1959.

As a result of an agreement made with the Société Ugine-Infra of France, furnaces of G.E.C. design have been supplied to a number of firms on the Continent. These furnaces include two batch type gas-carburizing furnaces, one using the drip-feed technique; one 100 kW vertical cylindrical furnace for microbrazing Nimonic alloy, and a 175 kW rotary hearth furnace. This furnace allows the complete hardening process, including cooling and quenching, to be completed without exposing the charge to the air.

A compact, standard laboratory vacuum furnace has been supplied to Rolls-Royce Ltd. Although the working dimensions of this furnace are only 3 in. in diameter and 6 in. in height, it is rated at 15 kW, and can operate at temperatures up to 1,800°C. with a vacuum of  $10^{-5}$  mm. of mercury. The furnace tank is so positioned that vertical pressure can be applied to a hot charge.

Two vacuum furnaces supplied to the G.E.C. Rectifier Works at Witton have a graphite element assembly providing heat-treatment temperatures up to 1,200°C., and are fitted with radiation screens of stainless steel and molybdenum.

The process of sheathing cables by the argon-arc welding of aluminium strip is now fully established in produc-

tion, and amongst the recent orders which Pirelli-General have undertaken for British Railways are 50-60 miles of aluminium-sheathed signal and communication cables for the Eastern Region, Colchester to Clacton electrification scheme, and 18 miles  $3 \times 0.1$  in<sup>2</sup> 33 kW oil-filled feeder and pilot and supervisory cables for the Southern Region on the East Kent electrification scheme.

The argon-arc welding process has also been applied to a wider range of materials, including the manufacture of copper sheath having a wall thickness of 0.010 in., and welded at speeds of 30-40 ft/min. A special machine installed at Pirelli-General for the joining of copper strip for coaxial cable conductors has effected a considerable reduction in cost of materials. The joining process has been developed whereby spot welds are made by an argon-arc struck for a precise length of time.

During the past five years considerable effort has been devoted to the development of equipment and techniques suitable for the growth of large germanium single crystals. These offer various advantages, compared with small crystals, in terms of process efficiency, machine capacity, and overall output, on a works scale. The present 5,000 gm. crystals, which are in normal production, are believed to be the largest pulled germanium crystals in the world.

The continued development of high power semiconductor rectifiers has resulted in the introduction of an improved design of germanium rectifier, and of a new silicon rectifier.

In modern technology there is a continuous quest for materials to operate at very high temperatures. The carbides, borides, nitrides and silicides of some of the transition elements are possible compounds for such use, tantalum carbide, for example, having a melting point approaching 4,000°C. Research into the properties and structure of these compounds has shown that they have many properties characteristic of metals, and has led to a better understanding of the interatomic bonding forces present.

A radiation pyrometer developed by the G.E.C. comprises a thermopile specially constructed to give an electrical output substantially independent of ambient temperature over a wide range of source temperature.

The device may be used with an aperture stop, or a system of collimating stops, in the path of the incident radiation. Alternatively, a radiation collecting probe may be employed. Polished rods of fused silica have been used effectively for this purpose in, for example, the monitoring of surface temperature in an induction hardening and tempering process where the source area was small and was normally obscured by quench oil, spray, and smoke.

## Standard Specifications

*Bronze Welding by Gas (B.S.1724 : 1959). Price 6s.*

**T**HIS revision of the 1951 edition of B.S.1724 brings the subject thoroughly up-to-date. It deals with the bronze welding by gas of: copper, mild steel, cast iron and malleable iron, and with the bronze welding of combinations of these metals.

Requirements are specified for workmanship, inspection and testing procedure, and filler metal, and for the preparation and testing of various joints.

Appendices to the 25 pp., illustrated publication provide information on welding flames, removal of flux residues, and composition of filler metals.

*Hot Dipped Galvanized Corrugated Steel Sheets for General Purposes (B.S.3083 : 1959). Price 4s. 6d.*

**F**OUR types of sheet, classified according to the weight of zinc coating, are specified in this standard. The more heavily-coated sheets are for purposes where climatic or other factors call for the highest degree of protection.

The dimensional requirements relate to the most commonly required sheets i.e. those having 3 in. corrugations.

Dimensional tolerances on the sheets are specified, as are profile and cover widths.

The standard includes requirements for the weights of zinc coating, and a method of test for determining them. It concludes with an appendix dealing with the overlap of corrugated sheets at the sides; this offers a guide to the purchaser in calculating the number of sheets required for any particular coverage.

Copies of the above-mentioned standards may be obtained from the British Standards Institution, 2 Park Street, London, W.1.

## Obituary

### Dr. Marcel Ballay

**I**T is with regret that we record the death of Dr. Marcel Ballay, President and managing director of the Centre d'Information du Nickel, Paris. He joined the Centre d'Information du Nickel as technical manager in 1928, becoming vice-president in 1950 and President in 1954, succeeding M. Jean Dhavernas.

# Industrial News

Home and Overseas

## British Foundry Exhibition

Between May 21-30 next, the Bingley Hall, Birmingham, will house the biggest concentration of exhibits and displays of foundry plant, equipment and supplies to be assembled as a collective indication of the industry's strides in mechanization, mechanical handling, and modernization generally.

Nearly 100 firms specializing in the manufacture and supply of foundry requisites will be taking part, and with many working exhibits. Special measures are being taken to enable furnaces to be used and molten metal to be handled.

This exhibition is sponsored by the **Foundry Trades' Equipment and Supplies Association Ltd.**, and Mr. G. E. Lunt, chairman of the exhibition committee and a former President of the association, has said that this exhibition has been under consideration for a long time, and it was felt that the resources, achievements and capabilities of the British foundry industry and its allied trades merited proper display under their own banner, and not merely as a section of any other trade exhibition.

The exhibition will not be open to the general public, and admission will be by ticket or trade card presented at Bingley Hall between 10 a.m. and 6 p.m. each day during the period of the exhibition, with the exception of Sunday.

## New Type Silver Anode

A recent announcement from **Johnson, Matthey and Co. Ltd.** is to the effect that they have investigated the influence that different metallic structures and physical conditions have upon the performance of high-purity silver anodes in silver plating baths. Several important conclusions were reached, and as a result the company has developed a new type of silver anode.

Matthey C.A. anodes, because of special processing, have a structure consisting of small equi-axed grains, and are particularly resistant to flaking or shedding in high speed plating baths. Moreover, the anodes show remarkable tolerance to variations in the composition of the electrolyte and in anode current density.

Further information on the research results is available on application to the company's head office in London.

## New Gas Scrubber

It has been announced by **Chemical Construction (G.B.) Ltd.** that the completion of a licensing agreement now enables them to offer the Svenska-Flaktfabriken Venturi Scrubber, in addition to their Pease-Anthony Venturi and Cyclonic type scrubbers.

The S.-F. Venturi Scrubber extends the range of their equipment to cover most gas cleaning problems that can be dealt with by wet scrubbing. Several advantages of this scrubber design have been proven, among which is the removal of solids which hitherto have often been found to adhere to scrubber walls. Where water supplies are limited, heavy slurries can be recirculated and process materials can be recovered in concentrated form.

Readers may remember that in the issue of this journal for August 15 last

year (page 134), a description, with illustration, of the Pease-Anthony Venturi and Cyclonic scrubbers was given.

## Fuel Oil Terminal

A new ocean-fed terminal, costing over £1 million, is being built by **Mobil Oil Company Limited** at Ellesmere Port, Cheshire. Facilities will be provided for the storage and distribution of a full range of petroleum products. It is hoped to have the installation completed by the autumn.

## Suction Sump Drainer

Emptying of machine tool sumps in most works presents a problem, as many are difficult to get at, in restricted spaces, and can only be cleaned some hours after the machine has ceased to be in use. Such sumps can now be emptied of swarf, grindings, sludge and cutting oil in a matter of minutes, without interfering with production, by the use of a suction sump drainer developed and manufactured by **Progress (Universal) Limited**.

This new unit has a 20 gal. capacity tank, mounted on a rubber-tyred carriage for easy mobility, and is fitted with 10 ft. of specially reinforced 1½ in. diameter flexible hose. To this can be fitted a variety of rubber probes for use in inaccessible places. Extra capacity can be obtained by having several drums "in series," so that one drum is filled and the overflow is sucked into the next, etc.

Driven by a ¼ h.p. capacitor motor, the impeller of the machine is protected against entry of liquid by a special valve in the tank. Another feature of the drainer is the built-in handle cable winder, which enables the operator to keep his hands free of oil and other dirt, as it is not necessary to handle the heavy duty three-core cable.

## Heads and Threads

Just published is the 1959 edition of the **Buyers' Guide of the British Bolt, Nut, Screw and Rivet Federation**. Following a number of pages devoted to a

directory of members' products, an article on "Standardization and the European Market" is contributed by Rear-Admiral Shattock and Mr. H. B. Curry. Then follows an index to British Standard Specifications and a list of such specifications.

A list of constituent associations within the Federation is included, and also a foreword from Major C. R. Dibben, C.B.E., chairman of the Federation.

## Automatic Die Production

New programming methods, evolved by engineers at **E.M.I. Electronics Ltd.** Hayes laboratories, now make it possible, it is said, to produce first-class dies on milling machines, direct from the drawing, without the use of an external computer.

Special mathematical techniques were devised to provide continuity in "blending" between the co-ordinates shown on the normal blueprint, and produce full three-dimensional workpieces. As in the other E.M.I. control systems, punched tape feeds instructions into what is, in effect, a built-in computer which controls the mill.

## Welding Set

Claimed to be the largest single-operator wheel-mounted A.C. welding set at present available, a unit providing a maximum intermittent welding current output of 700 amp. at 80 V has been introduced by **The General Electric Co. Ltd.** This set, designated the O.T.2, has a welding current output from 120 amp. to 700 amp. in 25 steps, with a continuous manual welding current rating of 650 amp. Rated at 52 kVA, in accordance with B.S.638 group Y, it consists of an oil-immersed single-phase transformer and separate choke enclosed in a fabricated sheet steel tank, which also can contain a 20 kVA air-cooled capacitor inside a separate compartment.

Regulating handles for coarse and fine current adjustments control the welding current. Primary transformer tappings



The new G.E.C. single-operator wheel-mounted A.C. welding set

are brought to a terminal board immediately beneath a small lid on the top cover, and provide for a primary voltage range from 380 to 550 V in six steps.

Full instructions for making the correct primary transformer connections, and for obtaining the required welding current are given on prominent diagram plates mounted on the top cover.

The components and windings are securely braced to prevent any possibility of movement even under the rough handling which gear of this type is likely to receive in service. The whole unit is mounted on four rubber-tyred wheels, with one pair guided by a towing handle.

#### Electrical Engineers Exhibition

An interesting exhibit at the forthcoming Electrical Engineers Exhibition, to be held at Earls Court, London, next month will be that provided by **Honeywell Controls Limited**. One item being featured (on Stand W.3) is a new sub-miniature switch—half the size of the smallest switch previously available—and which is being shown for the first time.

Two other new switches displayed include a plug-in Limit switch and the type LS compact Limit switch, both illustrating further advances in convenience and compactness of design. Part of the exhibit will be devoted to a display of thermostatic controls, which will provide even, economic space heating in offices and other buildings.

#### Induction Melting Furnace

Illustrated on this page is a construction view taken at **Birlec's** Birmingham works, in which an induction coil is shown being eased into position on a specially modified mains frequency coreless induction melting furnace. This furnace is for the **Imperial Smelting Corporation**, who are to use it in one of their zinc processes. To be rated at 300 kW, the furnace, which is designed to operate at about 1,000°C., will have a capacity of 5 tons.

#### Lecture Series

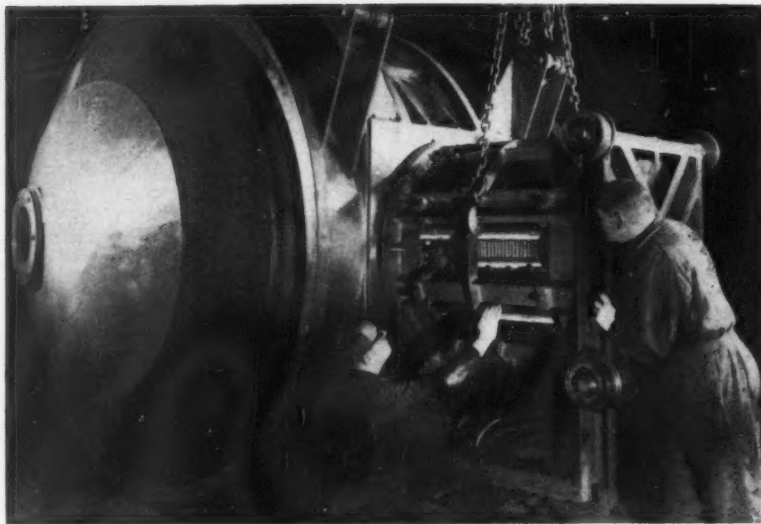
At their headquarters in London, the Holloware Division of the **Vitreous Enamel Development Council** recently gave the first of a series of lectures. A film on enamelling was shown and Mr. Arthur Murdock demonstrated B.S.I. tests on vitreous enamel. Mr. Jones and Mr. Gordon Swain answered pertinent and penetrating questions put to them by those present.

Hardware buyers and their assistants from London and suburban stores had been invited to the function, and it was evident from the close attention paid by the visitors to the lecture and discussion that great interest is being evinced in this series.

#### Beryllium Metal

Plans for the production of nuclear grade beryllium metal have been announced by **Imperial Smelting Corporation**, the U.K. subsidiary of Consolidated Zinc Corporation. For a number of years this company has been investigating, under contract to the United Kingdom Atomic Energy Authority, a thermal reduction method. This work has been successfully concluded, and beryllium metal of the highest purity has been produced.

The company is now commencing commercial production, and new plant is being installed at Avonmouth. The first



An induction coil being eased into position on a specially modified mains frequency coreless induction melting furnace, at the Birmingham works of Birlec Limited

stage for the production of limited quantities of nuclear grade beryllium metal will be in operation by the end of this year. A second stage will involve considerable expansion, and awaits confirmation of the anticipated demand for beryllium metal in connection with the development of the advanced gas-cooled reactor.

It is understood that this plant will be the first commercial production unit in the United Kingdom for virgin beryllium metal.

#### Institute of Metals

Future meetings of the Institute are announced as follows:—The Spring Meeting will be held in London from April 14 to 16 inclusive. The meeting of the Powder Metallurgy Joint Group, which was to have been held on March 12, has had to be postponed. It will now be held at Church House, Great Smith Street, London, S.W.1, on Wednesday, April 29, commencing at 9.30 a.m.

An informal dinner has been arranged by the **London Local Section** of the Institute to take place on Thursday, March 19, at 7 p.m., at the Horse Shoe Hotel, Tottenham Court Road, London, W.1.

#### U.K. Metal Stocks

Stocks of refined tin in London Metal Exchange warehouses at the end of last week fell by 253 tons, and were distributed as follows: London 5,966; Liverpool 6,089, and Hull 1,430 tons.

Stocks of refined copper rose by 635 tons and were as follows:—London 2,100; Liverpool 2,794; Birmingham 76; and Manchester 2,000 tons.

#### New Silicone Compounds

Two new silicone compounds with attractive characteristics are being made by **I.C.I. Nobel Division**. One is a cable rubber, and the other a silicone emulsion.

Elastomer E.372 is a 70° shore hardness cable rubber of improved physical properties, particularly in the elongation, which is now 225 per cent after a 24 hr. oven cure at 250°C. Because of its hardness and other good physical properties, the rubber is excellent for the sheathing, as well as the insulation, of cables. It

will satisfy an increasing demand for a cable rubber that is capable of indefinitely resisting ambient temperatures as high as 150°C., and as low as -50°C.

Silicone Emulsion M.401 is designed as a release agent in rubber and plastics moulding, and in some kinds of metal moulding.

#### Corrosion Exhibit

At the forthcoming Corrosion Exhibition, to be held at the Horticultural Hall, London, in April, the National Chemical Laboratory, D.S.I.R., will feature the work of its Corrosion of Metals group. The group's aim is to gain more knowledge of corrosion processes and of preventive measures, and to assist industry in the application of existing knowledge.

The two aspects of its work will be illustrated by examples of research in progress at the laboratory, and some typical corrosion problems on which advice has been given.

#### Piezoelectric Materials

Commercial production of new piezoelectric materials has now been commenced by **Brush Crystal Company Ltd.** The materials are polycrystalline ceramics based on a lead zirconate-titanate solid solution, and they possess a very high conversion efficiency combined with a usable temperature range of up to 250°C. Applications for the range of piezoelectric ceramics include pick-up elements, accelerometer and pressure cartridges, flaw detection probes, and high power ultrasonic transducers.

The temperature characteristics of one type are of an order that makes the production of ceramic filter elements a practical possibility.

#### Butyl Rubber Cables

Described as the first ship to be wired exclusively with butyl rubber cables, the M.V. "Loch Loyal" was built by Harland and Wolff Ltd., and is now commissioned on the U.K. to West Indies and North American Pacific Coast run. The overall length measures 503 ft., the moulded breadth 68 ft., and the gross tonnage is 11,000, the ship being powered by the latest Harland and Wolff seven-cylinder

turbo-charged single-acting motor engine, developing 10,300 b.h.p.

The 660 V and 250 V butyl rubber cable for all the generating, lighting and electrical circuits was supplied by **British Insulated Callender's Cables Ltd.** This type of cable is described as being particularly suitable for ship wiring; since it strongly withstands oxidation, retains its elasticity and strength over a long period and, having a low water absorption, it resists salt water corrosion. It also includes a resistance to oils, solvents, fire, and low temperatures.

#### Electronic Instruments

More than 400 instruments and controls will be displayed at the third annual exhibition of electronic devices provided by A. M. Lock and Company Ltd. at the Bennett Hall (Y.M.C.A.), Snow Hill, Birmingham, from March 17 to 20 next. A number of important new devices are to be exhibited for the first time, and many working demonstrations will be included.

Among the companies contributing to this exhibition are W. G. Pye and Co. Ltd., Elcontrol Ltd., Cossor Instruments Ltd., Sodoco Counters, Lock Instrumentation, Southern Instruments Ltd., Loma Metal Detectors Ltd., British Physical Labs., Evans Electro Selenium Ltd., and Thomas Industrial Automation.

#### Factory Equipment

Advice on the technique of oil-firing will be given by **Shell-Mex and B.P.** staffs at the Factory Equipment Exhibition, which is being held at Earls Court, London, in April next. Test equipment used by the company's fuel efficiency officers in advising factories on the operation of their oil-fired plant will be shown.

A new departure in the shielding and lagging of steel chimneys will be displayed, and each day a film strip will be shown illustrating the use of oil in smokeless zones and the applications of the Clean Air Act.

#### Lightweight Welding Blowpipe

Substitution of a lightweight welding blowpipe for a heavier type, although adding to the length of time of the actual welding process, is reported to have reduced overall time spent on fabrication of one type of sink unit for British and overseas markets. Although the welding process now takes 19 min., compared with 15 min. when the heavyweight torch was used, it has been found that the new equipment provides a more efficient weld of better quality.

The lightweight, high-pressure welding blowpipe is being used by Rubery Owen and Company Limited in the fabrication of Easiclene sink units. It affords full penetration from one side only. The units are fabricated from deep drawn 16 gauge mild steel sheet and, until recently, a heavyweight blowpipe was used to weld the bowl to the drainer assembly. The operation is now being carried out with a DH blowpipe of light design, together with a B-type high-pressure regulator, both supplied by **British Oxygen Gases Limited.**

On completion, the weld is planished, and the surface is then ground and finished. After a priming coat has been applied to the unit, it then receives two coats of vitreous enamel to provide maximum durability.

## Men and Metals

Changes in the boards of British Aluminium Company Limited and its subsidiary and associated companies have been announced. **Lord Portal** and **Mr. Geoffrey Cunliffe**, the chairman and deputy chairman, of the British Aluminium group, have left the boards. In their stead, **Sir Ivan Stedeford**, chairman of Tube Investments Limited, and **Mr. Richard S. Reynolds**, the present chairman of Reynolds Metals, have been elected directors of the board of British Aluminium, and Sir Ivan has been elected chairman of that company. Lord Portal became a director of British Aluminium in 1951 and was elected chairman in the following year. Mr. Cunliffe has served as a director of the company since before the war, and was elected deputy chairman in 1947.

It is announced by Metal Products Company (Willenhall) Limited that **Mr. S. C. Jones** has joined the company as consultant on technical and sales matters.

Chief chemist of the research laboratories of The General Electric Company Limited, at Wembley, **Mr. R. C. Chirnside** has been nominated by the Council of the Society for Analytical Chemistry as President-Designate to take office at the annual meeting, to be held next month.

Stated to have become the first woman to gain such a distinction, **Mrs. Brenda James** has been awarded a Higher National Certificate in Metallurgy at the Chance Technical College, Smethwick, Staffs. Mrs. James, who is an assistant experimental officer in the General Post Office laboratory at Bordesley Green, Birmingham, attended the College last week to receive her award and also the Chance Students' Union Society Prize for being the student whose progress throughout deserved special recognition.

A number of staff changes have recently been made at their rolling mills by The British Aluminium Company Limited as follows:—**Mr. A. J. Richmond** to be deputy manager at Falkirk; **Mr. T. D. Rees** to be deputy manager at Latchford; **Mr. R. L. C. McDonald** to be assistant manager at Warrington; **Mr. F. C. Foskett** to be chief production superintendent at Milton; **Mr. N. McDonald** to be deputy chief production superintendent at Milton; and **Mr. D. Lowe** to be superintendent of the experimental department at Milton.

Consequent upon the retirement of **Mr. H. W. L. Phillips** in September next, the following staff changes will be made at the Research Laboratories, Chalfont Park, by The British Aluminium Company Limited:—**Mr. A. C. Coates** will be assistant director of research (chemical); **Mr. P. C. Varley** to be assistant director of research (metallurgical); **Dr. C. E. Ransley** will

be given the title of senior research metallurgist, and **Dr. F. A. Champion** will be given the title of senior research chemist.

Assistant export sales manager of Simmonds Aeroaccessories Limited, **Mr. J. D. Wilson** is visiting Holland this month to call upon the company's agents in that country, and also to visit the Dutch motor show.

At the annual general meeting of the Electronic Engineering Association, held in London on Monday last, **Mr. L. T. Hinton** (Standard Telephones and Cables) was elected chairman in succession to **Mr. F. S. Mockford** (Marconi's Wireless Telegraph Company), and **Mr. R. R. C. Rankin** (Mullard Company) was elected vice-chairman.

## Forthcoming Meetings

**February 28**—Institute of British Foundrymen. Wales and Monmouth Branch. The Technical College, Newport. "Light Alloy Casting." T. Williams. 6 p.m.

**March 3**—Institute of Metal Finishing. Midland Branch. James Watt Memorial Institute, Great Charles Street, Birmingham, 3. General Discussion on Levelling Action. Opened by J. Edwards. 6.30 p.m.

**March 3**—Institute of Metals. Oxford Local Section. Cadena Café, Cornmarket Street, Oxford. "Metallurgical Applications of the Electron Microscope." J. Nutting. 7 p.m.

**March 3**—Institute of Metals. South Wales Local Section. Department of Metallurgy, University College, Singleton Park, Swansea. "Effects of Vacancies and Other Point Defects in Metals." A. H. Cottrell. 6.30 p.m.

**March 4**—Society of Chemical Industry. Corrosion Group. Society of Chemical Industry, 14 Belgrave Square, London, S.W.1. "The Diagnosis of the Causes of Corrosion Failures": "A Systematic Scheme for Examining Corroded Metal Specimens," J. B. Cotton; "The Examination of the Corrosion Products of Aluminium and its Alloys," R. A. Hine; "Investigation of Corrosion Failures of Iron and Steel," E. E. White and K. A. Chandler. 6.30 p.m.

**March 4**—Institute of Metal Finishing. Scottish Branch. Institution of Engineers and Shipbuilders in Scotland, 39 Elmbank Crescent, Glasgow. "Deposition of Precious Metals" with comments on "Recovery." R. R. Benham. 7.30 p.m.

**March 5**—Institute of Metal Finishing. North-West Branch. Engineers' Club, Albert Square, Manchester. "Airless Spraying and Heat Spraying." T. Cowland. 7.30 p.m.

**March 5**—Institute of Metals. London Local Section. (Joint Meeting with the Institute of Welding.) 17 Belgrave Square, London, S.W.1. "High Temperature Brazing." A. Cibula. 6.30 p.m.

**March 5**—Leeds Metallurgical Society. Lecture Room "C," Chemistry Wing, The University, Leeds, 2. "Metallurgical Applications of High-Resolution Microscopy." J. Nutting. 7.15 p.m.

# Metal Market News

**T**HE January copper statistics, issued by the Copper Institute, were regarded as disappointing, inasmuch as there was once again an increase in stocks outside the United States. Nor was there any compensating reduction inside, for the American total was virtually unchanged. In short tons of 2,000 lb., the details are as follows: crude copper production inside the United States was 109,523, against 105,552, while the output of refined copper was 137,361, compared with 146,978. Deliveries were nearly 2,000 tons lower at 114,425 tons, while stocks, at 80,780 tons, were up by about 60 tons. Outside the United States, production at 163,115 tons compared with 156,843 tons in December, while the output of refined was 133,497 tons, compared with 135,213 tons. Deliveries, at 134,007 tons, were disappointing, being 10,524 tons below the December figure. As already mentioned, stocks went up, the total at January 31, at 201,000 tons, being nearly 22,000 tons up on the December figure. The British Bureau of Non-Ferrous Metal Statistics have issued details of December usage, and also totals for the year 1958. In the last month of the year the industry absorbed 56,700 tons of copper, of which about 10,700 tons was secondary. The December total showed a drop of about 2,500 tons compared with November, which was, in turn, about 6,000 tons below the excellent October figures. For the year 1958, total copper consumption was 667,978 tons, compared with 641,484 tons in the preceding year.

Business last week quietened down considerably, the turnover on the standard copper market being 8,450 tons. Without much change in the quotation during the week, the close on Friday afternoon was rather below the best, at £236 15s. 0d. cash and three months. On balance, this meant a drop of 25s. in cash and of 10s. in the forward position. Stocks again increased substantially, by 740 tons to 6,335 tons, and this, combined with the January statistics, quoted above, certainly did nothing to help the price. However, at the beginning of the week the custom smelters added 50 points to their price, which advanced to 30½ cents, while during the second half of the week it became known that a strike was in being at the Cerro de Pasco property. However, consumer interest on this side was so poor that the market sagged in spite of these two bull points. In the States, business is reported as good, and as we write there is talk of the custom smelters' quotation being advanced again in the near future. For some time now there has been a school of thought which believes that the price this year will be seen at 32 cents, if not higher.

The tin market showed considerable strength last week in the expectation that export quotas would not be increased, and the close on Friday afternoon showed substantial gains. Cash, at £775, was £6 up, and three months, at £777 10s. 0d., showed a gain of £7 10s. 0d. However, on the late Kerb on Friday afternoon a spasm of weakness brought the forward quotation down to £772. Later on it was announced that, for the second quarter, producing members of the Tin Agreement would be permitted to increase their exports by 3,000 tons. At the beginning of the week it had been announced that L.M.E. stocks of tin were 723 tons down at 13,738 tons, and it is expected that this trend will continue. Trading in lead and zinc was not very brisk, but both metals advanced. At £69 17s. 6d., February lead was 7s. 6d. higher on balance, while May closed 10s. up at £71. In zinc, there was an advance of £1 2s. 6d. in February to £74 17s. 6d., while May, at £72 15s. 0d., closed £1 higher than a week earlier.

## Birmingham

Conditions continue quiet in the Birmingham area, and there is no indication yet of the much-looked-for revival of buying. The motor trade continues to find work for some thousands in Birmingham, Coventry, and the adjoining towns and, while production slowed down a little recently, it is encouraging to note that exports increased. Substantial contracts have been booked by the manufacturers of heavy electrical equipment, including work for home and overseas railways. Makers of machine tools have worked off much of the backlogs of orders, and there is not enough work to keep plant running to full capacity.

Steel makers have great difficulty in securing new business. Re-rolling mills are likely to be on short time for the next few weeks unless the market improves in the meantime. Demand for light castings is a little better, due to expansion in orders for domestic castings. One result of the depression is to reduce the amount of foreign steel coming into the country. Imports are lower than they have been for a very long time. Plate mills are still well occupied, and sheets for the motor trade continue the bright spot in an otherwise dull picture. Supplies of pig iron are ample for all requirements. Most descriptions of steel can be obtained promptly either from manufacturers or through merchants.

## New York

Tin, after being unstable in early dealings, steadied in the late afternoon. The early instability followed receipt

of the International Tin Council communique increasing export quotas for the second quarter of 1959 to 23,000 tons. Some business was reported in March at about half a cent off from the early highs, but trade sources said this was not truly indicative of the market, since the seller was not recognized as a leading tin dealer. The market price is still unsettled, but it appears slightly above the previous day's close.

Copper futures were strong on very brisk covering and new buying. Custom smelters reported continued active sales. Producers noted they are about sold out for March. Scrap copper was up another quarter of a cent per pound to 25½ cents, which brings a custom smelter price of 31 cents closer, some sources said.

Lead and zinc were quiet.

Operating results of the Anaconda Company were announced recently by Mr. Clyde E. Weed, chairman of the board, in advance of the annual report, which will be released next month. Mr. Weed reported that estimated consolidated net income of the company for the fourth quarter of 1958, including certain year-end adjustments, amounted to 14,500,000 dollars, or 1.35 dollars per share. Net income for the fourth quarter of 1957 was 9,028,222 dollars, or 87 cents per share.

Estimated consolidated net income for the entire year 1958, subject to year-end audit, is 33,800,000 dollars, or 3.15 dollars per share on the 10,714,627 shares of capital stock outstanding. For the year 1957, net income was 44,008,349 dollars, or 4.23 dollars per share on 10,409,191 shares of capital stock outstanding at that time. Mr. Weed said that net income for 1958 was adversely affected by lower prices received for non-ferrous metals, reduced demand for fabricated products, a 50-day strike at the properties of Chile Exploration Company, and the general business recession.

He commented, however, that improved demand for copper in the U.S. during the last quarter, together with the continued high rate of consumption in Europe and loss of production because of strikes in foreign mines, reversed the balance of supply and demand.

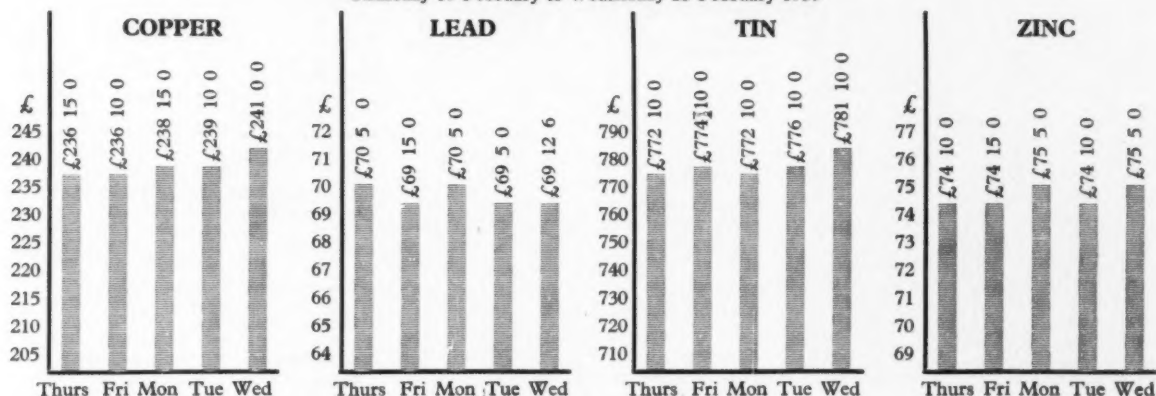
## Zurich

Little change has been noted in the dull trend on the Swiss non-ferrous metal market, despite the improvement in orders placed with engineering works and other large consumers. The trade reports that, in general, consumers are still buying for day-to-day uses, and are not in the market for stock replenishment. Dealers still anticipate an improvement in turn-overs this spring, especially with firms supplying the building industry.

# Non-Ferrous Metal Prices

## London Metal Exchange

Thursday 19 February to Wednesday 25 February 1959



## Primary Metals

All prices quoted are those available at 2 p.m. 25/2/59

		£	s.	d.		£	s.	d.		£	s.	d.
Aluminium Ingots....	ton	180	0	0	Copper Sulphate ....	ton	76	0	0	Palladium .....	oz.	5 15 0
Antimony 99.6% ....	"	197	0	0	Germanium .....	grm.	—			Platinum .....	"	25 0 0
Antimony Metal 99%..	"	190	0	0	Gold .....	oz.	12 9 6½			Rhodium .....	"	40 0 0
Antimony Oxide.....	"	180	0	0	Indium .....	"	10	0		Ruthenium .....	"	14 0 0
Antimony Sulphide					Iridium .....	"	20	0	0	Selenium .....	lb.	nom.
Lump .....	"	190	0	0	Lanthanum .....	grm.	15	0		Silicon 98%.....	ton	nom.
Antimony Sulphide					Lead English.....	ton	69 12 6			Silver Spot Bars....	oz.	6 6
Black Powder.....	"	205	0	0	Magnesium Ingots....	lb.	2 3			Tellurium .....	lb.	15 0
Arsenic .....	"	400	0	0	Notched Bar .....	"	2 9½			Tin .....	ton	781 10 0
Bismuth 99.95%.....	lb.	16	0		Powder Grade 4.....	"	6 1			*Zinc		
Cadmium 99.9% .....	"	9 6			Alloy Ingot, A8 or AZ91	"	2 4			Electrolytic.....	ton	—
Calcium .....	"	2 0 0			Manganese Metal....	ton	247 0 0			Min 99.99% .....	"	—
Cerium 99% .....	"	16 0 0			Mercury .....	flask	74 0 0			Virgin Min 98% .....	"	74 3 9
Chromium .....	"	6 11			Molybdenum .....	lb.	1 10 0			Dust 95/97% .....	"	109 0 0
Cobalt .....	"	14 0			Nickel .....	ton	600 0 0			Dust 98/99% .....	"	115 0 0
Columbite.... per unit		—			F. Shot .....	lb.	5 5			Granulated 99+% ..	"	99 3 9
Copper H.C. Electro..	ton	241 0 0			F. Ingot .....	"	5 6			Granulated 99.99+%	"	113 3 9
Fire Refined 99.70%	"	240 0 0			Osmium .....	oz.	nom.			*Duty and Carriage to customers' works for buyers' account.		
Fire Refined 99.50%	"	239 0 0			Osmiridium .....	"	nom.					

## Foreign Quotations

Latest available quotations for non-ferrous metals with approximate sterling equivalents based on current exchange rates

	Belgium fr/kg ≙ £/ton	Canada c/lb ≙ £/ton	France fr/kg ≙ £/ton	Italy lire/kg ≙ £/ton	Switzerland fr/kg ≙ £/ton	United States c/lb ≙ £/ton
Aluminium		22.50 185 17 6	210 157 10	375 221 5	2.50 212 10	26.80 214 10
Antimony 99.0			220 165 0	445 262 10		29.00 232 0
Cadmium			1,350 1,012 10			145.00 1,160 0
Copper						
Crude				450 265 10		
Wire bars 99.9						
Electrolytic	32.50 239 10	29.00 239 10	326 244 10		2.95 250 15	30.00 240 0
Lead		11.00 90 17 6	103 77 5	167 98 10	.87 74 0	11.50 92 0
Magnesium						
Nickel		70.00 578 5	900 675 0	1,200 708 0	7.50 637 10	74.00 592 0
Tin	112.75 829 17 6		1,105 828 15	1,500 885 0	9.40 799 0	103.37 827 0
Zinc						
Prime western		11.25 93 0 0				11.50 92 0
High grade 99.95		11.85 97 17 6				
High grade 99.99		12.25 101 2 6				
Thermic			110.00 82 10			
Electrolytic			118.00 88 10	169 99 15	.93 79 0	12.75 102 0

# Non-Ferrous Metal Prices (continued)

## Ingot Metals

All prices quoted are those available at 2 p.m. 25/2/59

Aluminium Alloy (Virgin)			£	s.	d.
B.S. 1490 L.M.5	ton	210	0	0	
B.S. 1490 L.M.6	"	202	0	0	
B.S. 1490 L.M.7	"	216	0	0	
B.S. 1490 L.M.8	"	203	0	0	
B.S. 1490 L.M.9	"	203	0	0	
B.S. 1490 L.M.10	"	221	0	0	
B.S. 1490 L.M.11	"	215	0	0	
B.S. 1490 L.M.12	"	223	0	0	
B.S. 1490 L.M.13	"	216	0	0	
B.S. 1490 L.M.14	"	224	0	0	
B.S. 1490 L.M.15	"	210	0	0	
B.S. 1490 L.M.16	"	206	0	0	
B.S. 1490 L.M.18	"	203	0	0	
B.S. 1490 L.M.22	"	210	0	0	

Aluminium Alloys (Secondary)			£	s.	d.
B.S. 1490 L.M.1	ton	142	10	0	
B.S. 1490 L.M.2	"	152	0	0	
B.S. 1490 L.M.4	"	169	0	0	
B.S. 1490 L.M.6	"	186	0	0	

†Average selling prices for mid October

Aluminium Bronze			£	s.	d.
BSS 1400 AB.1	ton	230	0	0	
BSS 1400 AB.2	"	244	0	0	

Brass			£	s.	d.
BSS 1400-B3 65/35	ton	153	0	0	
BSS 249	"	—	—	—	—
BSS 1400-B6 85/15	"	197	0	0	

Gunmetal			£	s.	d.
R.C.H. 3/4% ton	"	—	—	—	—
(85/5/5/5)	"	189	0	0	
(86/7/5/2)	"	198	0	0	
(88/10/2/1)	"	240	0	0	
(88/10/2/1)	"	252	0	0	

Manganese Bronze			£	s.	d.
BSS 1400 HTB1	"	191	0	0	
BSS 1400 HTB2	"	—	—	—	—
BSS 1400 HTB3	"	—	—	—	—

Nickel Silver			£	s.	d.
Casting Quality 12%	"	215	0	0	
" 16%	"	225	0	0	
" 18%	"	240	0	0	

Phosphor Bronze			£	s.	d.
B.S. 1400 P.B.1 (A.I.D. released)	"	291	0	0	
B.S. 1400 L.P.B.1	"	207	0	0	

\*Average prices for the last week-end.

Phosphor Copper			£	s.	d.
10%	ton	251	0	0	
15%	"	254	0	0	

Phosphor Tin			£	s.	d.
5%	"	—	—	—	—

Silicon Bronze			£	s.	d.
BSS 1400-SB1	"	248	0	0	

Soldier, soft, BSS 219			£	s.	d.
Grade C Tinmans	"	360	3	0	
Grade D Plumbers	"	289	9	0	
Grade M	"	395	6	0	

Soldier, Brazing, BSS 1845			£	s.	d.
Type 8 (Granulated)	lb.	—	—	—	—
Type 9	"	—	—	—	—

Zinc Alloys			£	s.	d.
Mazak III	ton	106	8	9	
Mazak V	"	110	8	9	
Kayem	"	116	8	9	
Kayem II	"	122	8	9	
Sodium-Zinc	lb.	2	6		

## Semi-Fabricated Products

Prices vary according to dimensions and quantities. The following are the basis prices for certain specific products.

Aluminium			£	s.	d.
Sheet 10 S.W.G.	lb.	2	8	1	
Sheet 18 S.W.G.	"	2	10	1	
Sheet 24 S.W.G.	"	3	1	1	
Strip 10 S.W.G.	"	2	8	1	
Strip 18 S.W.G.	"	2	9	1	
Strip 24 S.W.G.	"	2	11	1	
Circles 22 S.W.G.	"	3	2	1	
Circles 18 S.W.G.	"	3	1	1	
Circles 12 S.W.G.	"	3	0	1	
Plate as rolled	"	2	8	1	
Sections	"	3	2	1	
Wire 10 S.W.G.	"	2	11	1	
Tubes 1 in. o.d. 16 S.W.G.	"	4	1	1	

Aluminium Alloys			£	s.	d.
BS1470. HS10W.	"	3	1	1	
Sheet 10 S.W.G.	"	3	3	1	
Sheet 18 S.W.G.	"	3	11	1	
Sheet 24 S.W.G.	"	3	1	1	
Strip 10 S.W.G.	"	3	1	1	
Strip 18 S.W.G.	"	3	2	1	
Strip 24 S.W.G.	"	3	10	1	
BS1477. HP30M.	"	2	11	1	
Plate as rolled	"	2	11	1	
BS1470. HC15WP.	"	3	9	1	
Sheet 10 S.W.G.	"	4	2	1	
Sheet 18 S.W.G.	"	5	0	1	
Sheet 24 S.W.G.	"	3	10	1	
Strip 10 S.W.G.	"	4	2	1	
Strip 18 S.W.G.	"	4	9	1	
Strip 24 S.W.G.	"	4	9	1	
BS1477. HPC15WP.	"	3	6	1	
Plate heat treated	"	3	6	1	
BS1475. HG10W.	"	3	10	1	
Wire 10 S.W.G.	"	3	10	1	
BS1471. HT10WP.	"	5	0	1	
Tubes 1 in. o.d. 16 S.W.G.	"	5	0	1	
BS1476. HE10WP.	"	3	1	1	
Sections	"	3	1	1	

Brass			£	s.	d.
Tubes	"	1	10	1	
Brazed Tubes	"	—	—	—	—
Drawn Strip Sections	"	—	—	—	—
Sheet	ton	—	—	—	—
Strip	"	253	10	0	
Extruded Bar	lb.	2	0	1	
Extruded Bar (Pure Metal Basis)	"	—	—	—	—

Brass			£	s.	d.
Condenser Plate (Yellow Metal)	ton	189	0	0	
Condenser Plate (Naval Brass)	"	200	0	0	
Wire	lb.	2	1	8	1

Beryllium Copper			£	s.	d.
Strip	"	1	4	11	
Rod	"	1	1	6	
Wire	"	1	4	9	

Copper			£	s.	d.
Tubes	lb.	2	3	1	
Sheet	ton	268	0	0	
Strip	"	268	0	0	
Plain Plates	"	—	—	—	—
Locomotive Rods	"	—	—	—	—
H.C. Wire	"	287	15	0	

Cupro Nickel			£	s.	d.
Tubes 70/30	lb.	3	7		

Lead			£	s.	d.
Pipes (London)	ton	112	5	0	
Sheet (London)	"	110	0	0	
Tellurium Lead	"	£6 extra			

Nickel Silver			£	s.	d.
Sheet and Strip 7%	lb.	3	8		
Wire 10%	"	4	2	1	

Phosphor Bronze			£	s.	d.
Wire	"	4	1	1	

Titanium (1,000 lb. lots)			£	s.	d.
Billet over 4" dia.-18" dia.	lb.	63/-	64/-		
Rod 4" dia.-250" dia.	lb.	75/-	112/-		
Wire under .250" dia.-.036" dia.	"	146/-	222/-		
Sheet 8" x 2' x .250"-010"	"	88/-	157/-		
Strip .048"-003"	"	100/-	350/-		
Tube	"	—	300/-		
Extrusions	"	—	120/-		

Zinc			£	s.	d.
Sheet	ton	109	15	0	
Strip	"	nom.			

## Domestic and Foreign

Merchants' average buying prices delivered, per ton, 24/2/59.

Aluminium			£
New Cuttings			145
Old Rolled			125
Segregated Turnings			95

Brass			£
Cuttings			160
Rod Ends			145
Heavy Yellow			122
Light			117
Rolled			150
Collected Scrap			117
Turnings			140

Copper			£
Wire			214
Firebox, cut up			208
Heavy			204
Light			199
Cuttings			214
Turnings			194
Braziery			166

Gunmetal			£
Gear Wheels			190
Admiralty			190
Commercial			164
Turnings			159

Lead			£
Scrap			60

Nickel			£
Cuttings			—
Anodes			548

Phosphor Bronze			£
Scrap			164
Turnings			159

Zinc			£
Remelted			55
Cuttings			48
Old Zinc			37

## Financial News

### Consolidated Zinc Corporation

It is reported that the company plans to raise some £3.5 million by a "rights" issue to shareholders of one new £1 Ordinary share for every six held. The new money is understood to be required for the financing of a new zinc distillation plant at Swansea, and also a smelter to be erected in New South Wales. On the basis of current market prices, the new shares may be expected to be offered at round £2 8s. 0d. It is expected that the offer price and indications of the provisional net profit and final dividend for 1958 will be announced during the first week in next month.

### Thos. Bolton and Sons Ltd.

Trading profit, etc., for 1958, is shown at £201,845 (£241,364); net profit £41,423 (£71,941). Final dividend of 7½ per cent, making 10 per cent for the year (same).

## New Companies

The particulars of companies recently registered are quoted from the daily register compiled by Jordan and Sons Limited, Company Registration Agents, Chancery Lane, W.C.2.

**Electromark (G.B.) Limited** (617831), 292 Worton Road, Isleworth, Middx. Registered December 31, 1958. To carry on business of manufacturers of and dealers in equipment and materials for marking and surface treatment of metal and other substances, etc. Nominal capital, £10,000 in £1 shares. Directors: Thomas C. W. Roe, Ian M. E. Aitken and Clifford Garnett.

**Southern Aluminium Supplies Limited** (617970), 55 Sterte Ave., Poole, Dorset. Registered January 1, 1959. Nominal capital, £10,000 in £1 shares. Directors: Wm. C. V. Apps, Eric Brotherton, Helen A. J. Brotherton and Gerald R. Halsall.

**Southern Metal Warehouses Limited** (617971), 324-5 High Holborn, W.C.1. Registered January 1, 1959. Nominal capital, £1,000 in £1 shares. Directors: James C. La Roche and Arthur Glover.

**Northwood Metals Limited** (618133), Dormston Trading Estate, Burton Road, Upper Gornal, nr. Dudley. Registered

## A Special Police Message

In connection with the murder of one Sidney Slaney, a scrap metal merchant, at Plumstead, on January 17 last, the Metropolitan Police are seeking to establish the source of an ingot of tin found in the shed where the murder was committed. The ingot measures 6½ in. by 4½ in. by approximately ½ in., and a photograph of the ingot (half-size) is shown on this page.

An analysis shows that the composition of the ingot is as follows:—tin 99 per cent, lead 0.7 per cent, copper 0.09 per cent, iron 0.007 per cent, and antimony 0.2 per cent.

The following information has also been supplied by the police:—(1) the tin was cast into its present form by someone used to this type of work; (2) it was probably melted in an electric furnace; (3) it is not remelted scrap but new metal—could have originally been in anode form; (4) the mould was probably home-made.

Any members of the trade who may have any information regarding ingots of tin of a similar composition which are missing or may have been stolen prior to January 17 are asked to communicate



with the Detective Superintendent, "R" Division, Metropolitan Police, Woolwich Police Station, London, S.E.

January 2, 1959. To take over business of metal refiners and scrap merchants carried on at Upper Gornal as "Northwood Metals," etc. Nominal capital, £500 in £1 shares. Directors: Fred W. Box, Mrs. Marion M. Box and Anthony F. Box.

**Ralph Mackey Limited** (619049), Metal Works, Birt Street, Miles Platting, Manchester. Registered January 16, 1959. To carry on business of machinery and metal merchants, etc. Nominal capital, £1,000 in £1 shares. Directors: Ralph Mackey and Dora Mackey.

**Spring Finishing Limited** (619782), 109 Colmore Row, Birmingham, 3. Registered January 28, 1959. To carry on business of dealers in and importers and exporters of and workers in metals and minerals, etc. Nominal capital, £5,000 in £1 shares. Directors: Grahame H. Budgen and Raymond C. Hall.

## Trade Publications

**Grinding Machinery.**—Head Wrightson and Co. Ltd., Stockton Forge Works, Stockton-on-Tees, Co. Durham.

A four-page coloured brochure describes and illustrates the grinding machinery produced by this company.

**Scientific Instruments.**—Cambridge Instrument Co. Ltd., 13 Grosvenor Place, London, S.W.1.

Two brochures have been recently issued by this company. The first, of 16 pages, deals with some of the technical problems associated with gas analysis by the thermal conductivity method. It gives performance data on the Cambridge Katharometer, and includes notes on the types of measurement available and on the possible source of error. The second describes a new centre-line indicator-controller incorporating a novel display of the "Desired" and "Measured" values.

**A Machining Alloy.**—Northern Aluminium Company Ltd., Banbury, Oxon.

This four-page pamphlet deals with Noral 285 aluminium alloy, which has been developed specifically for machining purposes. It is particularly suitable for the production of light, inexpensive machined parts on automatic machines, because the swarf is produced as small chips and there is no build-up on the cutting tool edge. Included in the pamphlet are details of the alloy's mechanical and physical properties, and it lists recommended tool settings.

**Valve Data.**—English Electric Valve Company Ltd., Chelmsford, Essex.

This quick reference brochure gives abridged data for all the company's valves up to the time of printing. The brochure is sectionized, and also with a thumb index to the various types of valves available.

## Scrap Metal Prices

The figures in brackets give the English equivalents in £1 per ton:—

### West Germany (D-marks per 100 kilos):

Used copper wire ..	(£192.15.0)	220
Heavy copper .....	(£188.7.6)	215
Light copper .....	(£162.0.0)	185
Heavy brass .....	(£109.10.0)	125
Light brass .....	(£87.12.6)	100
Soft lead scrap .....	(£56.0.0)	64
Zinc scrap .....	(£39.10.0)	45
Used aluminium unsorted .....	(£78.16.0)	90

### France (francs per kilo):

Copper .....	(£195.0.0)	260
Heavy copper .....	(£195.0.0)	260
Light brass .....	(£116.5.0)	155
Zinc castings .....	(£48.15.0)	65
Lead .....	(£67.10.0)	90
Tin .....	—	—
Aluminium .....	(£112.10.0)	150

### Italy (lire per kilo):

Aluminium soft sheet		
clippings (new) ..	(£197.12.6)	335
Aluminium copper alloy	(£126.17.6)	215
Lead, soft, first quality	(£79.0.0)	134
Lead, battery plates	(£44.5.0)	75
Copper, first grade	(£209.10.0)	355
Copper, second grade	(£197.12.6)	335
Bronze, first quality machinery .....	(£203.10.0)	345
Bronze, commercial gunmetal .....	(£174.0.0)	295
Brass, heavy .....	(£138.12.6)	235
Brass, light .....	(£124.0.0)	210
Brass, bar turnings ..	(£126.17.6)	215
New zinc sheet clippings .....	(£57.5.0)	97
Old zinc .....	(£42.10.0)	72

# THE STOCK EXCHANGE

## Strong Trend Again Reported Throughout Industrial Market

ISSUED CAPITAL £	AMOUNT OF SHARE	NAME OF COMPANY	MIDDLE PRICE 24 FEBRUARY + RISE—FALL	DIV. FOR LAST FIN. YEAR	DIV. FOR PREV. YEAR	DIV. YIELD	1959		1958	
							HIGH	LOW	HIGH	LOW
£	£			Per cent	Per cent					
4,435,792	1	Amalgamated Metal Corporation ...	24/- —4½d.	9	10	7 10 0	24/10½	23/3	24/9	17/6
400,000	2/-	Anti-Accrion Metal ...	1/6	4	8½	5 6 9	—	—	1/9	1/3
41,305,038	Sck. (£1)	Associated Electrical Industries ...	55/3 +6d.	15	15	5 8 6	59/-	54/-	58/9	46/6
1,609,032	1	Birfield ...	57/6	15	15	5 1 6	59/-	57/1½	62/4½	46/3
3,196,667	1	Birmid Industries ...	73/6 +1/-	17½	17½	4 15 3	76/10½	72/6	77/6	55/3
5,630,344	Sck. (£1)	Birmingham Small Arms ...	36/9 —4½d.	11	10	5 19 9	40/4½	36/6	39/-	23/9
203,150	Sck. (£1)	Ditto Cum. A. Pref. 5% ...	16/3 +1/3	5	5	6 3 0	16/3	15/-	16/1½	14/7½
350,580	Sck. (£1)	Ditto Cum. B. Pref. 6% ...	17/9	6	6	6 15 3	18/1½	17/9	17/4½	16/6
500,000	1	Belton (Thos.) & Sons ...	27/6	10	12½	7 5 6	28/3	27/6	28/9	24/-
300,000	1	Ditto Pref. 5% ...	15/-	5	5	6 13 3	15/3	15/-	16/-	15/-
160,000	1	Booth (James) & Co. Cum. Pref. 7% ...	20/6	7	7	6 16 6	—	—	20/4½	19/-
1,500,000	Sck. (£1)	British Aluminium Co. Pref. 6% ...	18/9	6	6	6 8 0	19/7½	18/9	20/-	18/4½
15,000,000	Sck. (£1)	British Insulated Callender's Cables ...	47/6 —9d.	12½	12½	5 5 3	52/-	47/6	52/6	38/9
17,047,166	Sck. (£1)	British Oxygen Co. Ltd., Ord. ...	53/9 +1/9	10	10	3 14 6	54/7½	49/3	52/-	28/3
600,000	Sck. (5/-)	Canning (W.) & Co. ...	25/- +3d.	25 + *2½C	25	5 0 0	25/6	24/9	25/3	19/3
60,484	1/-	Carr (Chas.) ...	1/6	12½	25	8 6 9	—	—	2/3	1/4½
150,000	2/-	Case (Alfred) & Co. Ltd. ...	5/- +3d.	25	25	10 0 0	5/0½	4/7½	5/3	4/-
555,000	1	Clifford (Chas.) Ltd. ...	22/6	10	10	8 17 9	22/6	22/6	22/-	16/-
45,000	1	Ditto Cum. Pref. 6% ...	15/3	6	6	7 17 6	—	—	16/-	15/-
250,000	2/-	Coley Metals ...	3/3	20	25	12 6 3	3/3	2/10½	4/6	2/6
8,730,596	1	Cons. Zinc Corp.† ...	60/6 —1/9	18½	22½	6 4 0	67/6	60/6	65/3	41/-
1,509,528	1	Davy & United ...	94/- +1/3	20	15	4 5 0	94/-	86/-	87/-	45/9
2,915,000	5/-	Delta Metal ...	26/1½ —7½d.	30	*17½	5 14 9	26/9	24/1½	25/-	17/7½
4,600,000	Sck. (£1)	Enfield Rolling Mills Ltd. ...	46/- +1/6	12½	15B	5 8 9	46/6	36/7½	38/-	22/9
750,000	1	Evered & Co. ...	31/-	15Z	15	6 9 0	31/-	30/-	30/-	26/-
18,000,000	Sck. (£1)	General Electric Co. ...	32/6 —4½d.	10P	12½	40/3	32/3	40/6	29/6	
1,500,000	Sck. (10/-)	General Refractories Ltd. ...	40/- +1/9	20	17½	5 0 0	40/-	37/3	39/3	27/3
401,240	1	Gibbons (Dudley) Ltd. ...	65/-	15	15	4 12 3	66/6	65/-	67/6	61/-
750,000	5/-	Glacier Metal Co. Ltd. ...	6/9	11½	11½	8 10 3	7/1½	6/7½	8/3	5/-
1,750,000	5/-	Glynwed Tubes ...	18/7½ —3d.	20	20	5 7 3	19/3	16/4½	18/1½	12/10½
5,421,049	10/-	Goodlass Wall & Lead Industries ...	31/6 +1/3	13½	18Z	4 2 6	31/6	28/7½	30/9	17/3
342,195	1	Greenwood & Batley ...	79/6	20	17½	5 0 6	83/9	75/-	57/9	45/-
396,000	5/-	Harrison (B'ham) Ord. ...	15/3	*15	*15	4 18 3	15/3	15/-	15/9	11/6
150,000	1	Ditto Cum. Pref. 7% ...	19/6	7	7	7 3 6	—	—	19/9	18/4½
1,075,167	5/-	Heenan Group ...	7/9 +3d.	10	10½	6 9 0	8/3	7/6	9/7½	6/9
236,958,260	Sck. (£1)	Imperial Chemical Industries ...	35/9 +10½d.	12Z	10	4 9 6	38/3	33/9	38/-	24/3
34,736,773	Sck. (£1)	Ditto Cum. Pref. 5% ...	16/9	5	5	5 19 6	16/9	16/-	17/1½	16/-
14,584,025	**	International Nickel ...	164½ +1	\$2.60	\$3.75	2 16 6	164½	153	169	132½
860,000	5/-	Jenks (E. P.), Ltd. ...	9/6 +4½d.	14	27½d	7 7 3	10/-	8/9	10/-	6/7½
320,000	1	Johnson, Matthey & Co. Cum. Pref. 5% ...	16/3	5	5	6 3 0	16/3	15/4½	16/9	15/-
3,987,435	1	Ditto Ord. ...	48/- +2/6	10	10	4 3 3	48/-	44/3	47/-	36/6
600,000	10/-	Keith, Blackman ...	27/6	17½E	15	6 7 3	27/6	25/-	28/9	15/-
320,000	4/-	London Aluminium ...	5/4½ —1½d.	10	10	7 8 9	6/-	5/3	6/-	3/-
2,403,000	1	London Elec. Wire & Smith's Ord. ...	70/6 +6d.	15	12½	4 5 3	74/6	70/-	74/-	39/9
400,000	1	Ditto Pref. ...	24/9	7½	7½	6 1 3	25/3	24/3	24/3	22/-
765,012	1	McKechnie Brothers Ord. ...	43/3	15	15	6 18 6	45/-	43/3	45/-	32/-
1,530,024	1	Ditto A Ord. ...	41/3	15	15	7 5 6	43/6	41/3	45/-	30/-
1,103,268	5/-	Manganese Bronze & Brass ...	14/3	20	27½	7 0 3	14/3	13/9	14/1½	8/9
50,628	6/-	Ditto (7½% N.C. Pref.) ...	6/-	7½	7½	7 10 0	—	—	6/3	5/6
13,099,855	Sck. (£1)	Metal Box ...	73/6 +2/3	11	11	3 0 0	73/9	66/6	73/3	40/6
415,760	Sck. (2/-)	Metal Traders ...	9/- +6d.	50	50	11 2 3	9/1½	1/6	9/-	6/3
160,000	1	Mint (The) Birmingham ...	22/6 +6d.	10	10	8 17 9	22/6	22/-	22/9	19/-
80,000	5	Ditto Pref. 6% ...	70/6	6	6	8 10 3	75/6	69/-	83/6	69/-
3,705,670	Sck. (£1)	Morgan Crucible A ...	43/6	10	10	4 12 0	45/9	43/6	45/-	34/-
1,000,000	Sck. (£1)	Ditto 5½% Cum. 1st Pref. ...	18/-	5½	5½	6 2 3	18/6	18/-	18/-	17/-
2,200,000	Sck. (£1)	Murex ...	44/6 +9d.	17½	20	7 17 3	48/6	42/-	58/9	46/-
468,000	5/-	Ratcliffs (Great Bridge) ...	10/4½	10	10	4 16 6	11/3	10/4½	11/1½	6/10½
234,960	10/-	Sanderson Bros. & Newbould ...	28/3	20	27½D	7 1 6	28/3	27/9	27/3	24/6
1,365,000	Sck. (5/-)	Serck ...	18/1½	15	17½	4 2 9	19/-	18/-	18/7½	11/-
6,698,586	Sck. (£1)	Stone-Platt Industries ...	44/6 +1/3	15	12½	6 14 9	46/9	43/3	45/6	22/6
2,928,963	Sck. (£1)	Ditto 5½% Cum. Pref. ...	16/1½	5½	5½	6 16 6	16/7½	15/10½	16/3	12/7½
18,255,218	Sck. (£1)	Tube Investments Ord. ...	81/9 —9d.	17½	15	4 5 6	83/3	72/-	86/-	48/4½
41,000,000	Sck. (£1)	Vickers ...	34/3	10	10	5 16 9	37/-	34/-	36/3	28/9
750,000	Sck. (£1)	Ditto Pref. 5% ...	15/-	5	5	6 13 3	15/0½	14/7½	15/9	14/3
6,863,807	Sck. (£1)	Ditto Pref. 5% tax free ...	22/-	*5	*5	7 0 0A	22/7½	21/7½	23/-	21/3
2,200,000	1	Ward (Thos. W.), Ord. ...	84/6 +6d.	20	15	4 14 9	87/6	83/6	87/3	70/9
2,666,034	Sck. (£1)	Westinghouse Brake ...	43/9 +2/-	10	10	4 11 6	47/-	39/9	46/6	32/6
225,000	2/-	Wolverhampton Die-Casting ...	8/10½	30	25	6 15 3	9/-	8/8½	10/1½	7/-
591,000	5/-	Wolverhampton Metal ...	22/6	27½	27½	6 2 0	22/6	21/6	22/9	14/9
78,465	2/6	Wright, Bindley & Gell ...	6/- +6d.	20	20	8 6 9	6/-	4/11½	5/4½	2/9
124,140	1	Ditto Cum. Pref. 6% ...	13/-	6	6	9 4 6	—	—	13/-	11/3
150,000	1/-	Zinc Alloy Rust Proof ...	2/10½	27	40D	9 8 0	3/-	2/9	3/1½	2/7½

\*Dividend paid free of Income Tax. †Incorporating Zinc Corp. & Imperial Smelting \*\*Shares of no Par Value. ‡ and 100% Capitalized Issue. ●The figures given relate to the issue quoted in the third column. A Calculated on £7 14 6 gross. Y Calculated on 11½% dividend. ||Adjusted to allow for capitalization issue. E for 15 months. D and 50% capitalized issue. Z and 50% capitalized issue. B equivalent to 12½% on existing Ordinary Capital after 100% capitalized issue. † And 100% capitalized issue. X Calculated on 17½%. C Paid out of Capital Profits. E and 50% Capitalized issue in 7% 2nd Pref. Shares. P Interim dividend since reduced.

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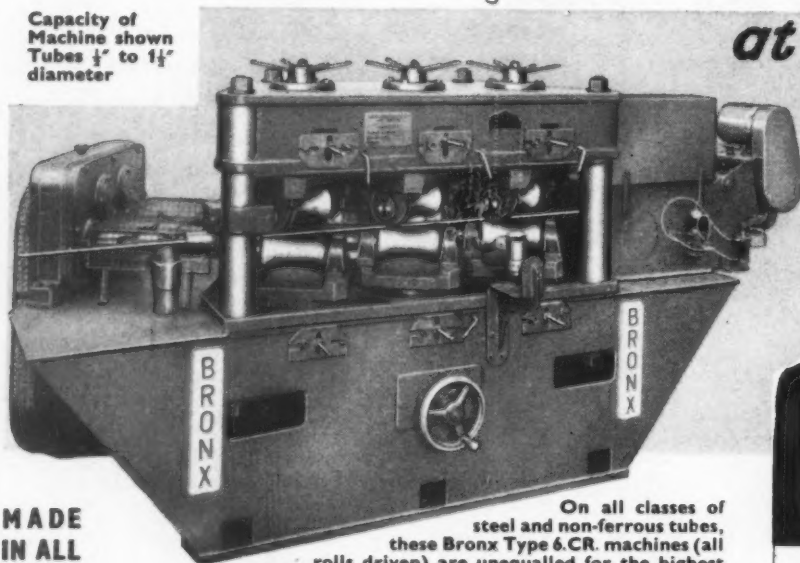
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Capacity of Machine shown  
Tubes  $\frac{1}{4}$ " to  $1\frac{1}{4}$ " diameter



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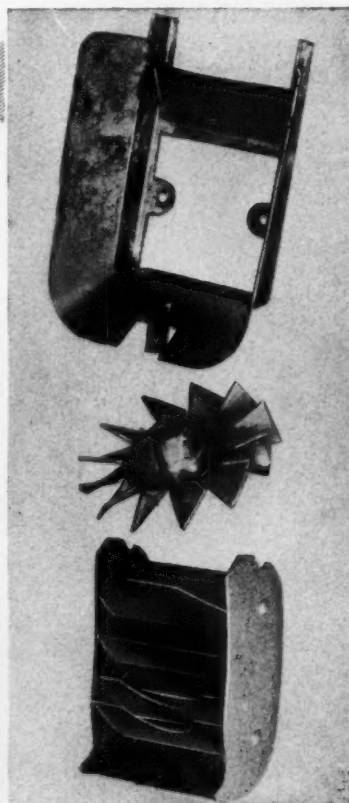
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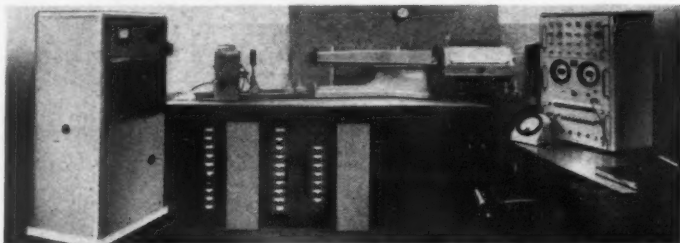
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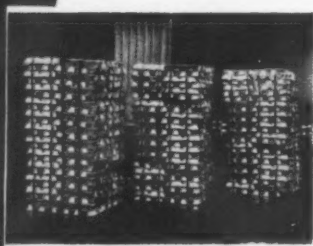
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1 ton gunmetal in 40 minutes.

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only 2% for 60/40 brass.

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3½ gallons oil to melt 500 lb. brass in 30 minutes.

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Continuous production assured—rebrick in a weekend.

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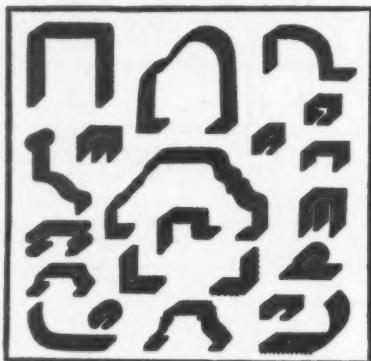
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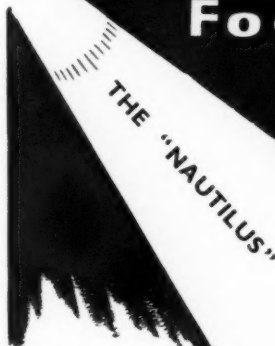
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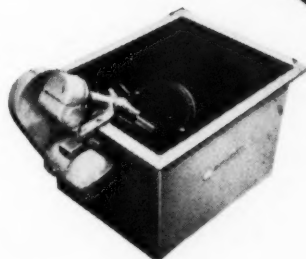
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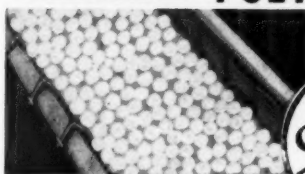
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